Humboldt-Universität zu Berlin
Sprach- und literaturwissenschaftliche Fakultät
Institut für deutsche Sprache und Linguistik

Masterarbeit
zur Erlangung des akademischen Grades
Master of Arts (M.A.)
im Fach Linguistik

What's the alternative?
Experimental research on the extent of focus alternative sets

eingereicht von

Anna-Lisa Ndao

Matrikelnummer 577792

Wissenschaftliche Betreuer:

Prof. Dr. Katharina Spalek

Prof. Dr. Manfred Krifka

Berlin, den 14. August 2017

Abstract

The correct use and interpretation of a sentence's information structure are key for successful communication. One main notion of information structure is focus. According to Rooth's alternative semantics (1985, 1992), the main function of focus is to evoke contextually relevant alternatives for a focused element, and previous experimental research has shown that these alternatives are indeed cognitively real entities that are being activated when computing focus.

The present thesis investigates which particular elements are part of this set of alternatives that is activated when processing a focused element. More specifically, it aims to adjudicate between the permissive theory by Rooth (1985, 1992) and the restrictive theory by Wagner (2006, 2012), which make different empirical predictions on the extent of focus alternative sets.

To gain experimental evidence in favour of either of the two theories, a cross-modal priming paradigm experiment was conducted. Participants completed a lexical decision task on a visually presented target word after hearing a short dialogue containing a focused adjective. The target word was either an alternative according to the permissive theory, an alternative according to the restrictive theory or an unrelated target word that was not alternative for the focused adjective. The rationale is that if a target word is part of the alternative set of the focused word, it should be activated when computing the focused adjective. This activation should then positively affect the subsequent lexical decision task.

The results suggest that both types of alternatives were activated when processing the focused elements. Thus, the study indicates that listeners consider a relatively broad set of focus alternatives, providing evidence in favour of the permissive theory by Rooth (1985, 1992).

Zusammenfassung

Erfolgreiche Kommunikation basiert unter anderem auf dem korrekten Gebrauch und der angemessenen Interpretation von Informationsstruktur. Ein essentieller Aspekt von Informationsstruktur ist Fokus. Nach Auffassung der Alternativensemantik von Rooth (1985, 1992) hat Fokus die grundlegende Funktion kontextuell relevante Alternativen zum fokussierten Element zu evozieren. Diese theoretische Annahme wurde bereits von experimentellen Studien untermauert, die Evidenz dafür lieferten, dass Alternativen tatsächlich kognitiv reale Entitäten darstellen, die während der Verarbeitung von Fokus aktiviert werden.

Die vorliegende Arbeit beschäftigt sich mit der Frage, welche Elemente Teil dieses Alternativensets sind, das bei der Fokusverarbeitung aktiviert wird. Genauer gesagt ist das Ziel dieser Arbeit zwischen der permissiven Theorie von Rooth (1985, 1992) und der restriktiven Theorie von Wagner (2006, 2012) zu urteilen, die beide unterschiedliche Annahmen zum Umfang von Alternativensets machen.

Um die beiden Theorien entweder durch experimentelle Evidenz zu unterstützen oder aber ihre Annahmen in Frage zu stellen, wurde ein Experiment mit einem cross-modalen Primingparadigma durchgeführt. Die Versuchsteilnehmer hörten zunächst einen kurzen Dialog, der ein fokussiertes Adjektiv enthielt und absolvierten anschließend eine lexikalische Entscheidungsaufgabe auf Basis eines visuell präsentierten Zielwortes. Dieses Zielwort war entweder eine Alternative nach Auffassung der permissiven Theorie, eine Alternative nach Auffassung der restriktiven Theorie oder aber ein unrelatiertes Wort, das keine Alternative für das fokussierte Adjektiv darstellte. Die zugrundeliegende Logik dieses Aufbaus ist die Annahme, dass ein Zielwort während der Verarbeitung des fokussierten Wortes aktiviert werden sollte, wenn es Teil dessen Alternativensets ist. Diese Aktivierung sollte die anschließende lexikalische Entscheidungsaufgabe dann in positiver Weise beeinflussen.

Die Ergebnisse der Studie deuten darauf hin, dass beide Typen von Alternativen während der Verarbeitung der fokussierten Elemente aktiviert worden sind und Hörer demzufolge ein relativ breit angelegtes Set von Fokusalternativen zu erwägen scheinen. Diese Erkenntnisse stützen somit die permissive Theorie von Rooth (1985, 1992).

Contents

I. List of Figures

II. List of Tables

1. Introduction

People are surrounded by language. Every day, they have countless verbal or written conversations in which they share news or feelings, inform, teach, amuse, flirt, tell off, instruct, praise or simply connect with others. Although it seems as if people exchange these vast amounts of information effortlessly, each discourse requires a person to make numerous decisions about how to communicate their message to a particular interlocutor. A speaker uses information structure to convey the information in such a way that best serves his[1] current communicative need (Chafe, 1976), and thus supports listeners in identifying the core message as intended by the speaker. Chafe (1976) referred to information structure as the 'packaging' of information, which is primarily concerned with how information is conveyed and not with the information itself[2], "just as the packaging of toothpaste can affect sales in partial independence of the quality of the toothpaste inside" (Chafe, 1976, p. 27-28). One aspect of information structure is focus.

In many languages, including German and English, focus can be realised by using a pitch accent. By prosodically marking a word, a phrase or a sentence, the focused element(s) become privileged in language comprehension (Gotzner, Wartenburger & Spalek, 2016). There has been evidence that focus structure guides listeners' attention (e.g. Cutler & Fodor, 1979) and that focused elements seem to have a special representation in memory as they are better remembered than non-focused elements (e.g. Fraundorf, Watson & Benjamin, 2010).

However, according to the alternative semantics theory by Rooth (1985, 1992), the primary function of focus is to introduce alternatives for the focused element into the computation of the sentence. Consider example (1), where the object is focused, as indicted by the subscript *F*.

(1) Emilia cooked $[\text{pork}]_F$

[1] The person is referred to as being male only for matters of simplification. Of course, the same holds true for females.

[2] While the term 'packaging' nicely illustrates the concept of information structure, it is not completely accurate. As Krifka (2007) points out, information structure can affect the message itself, as is the case with focus sensitive particles, which affect a sentence's truth condition. See Chapter 2.1.1 and 2.1.2 for further information on the effect of focus particles.

A listener hearing this sentence might think about all the possible other things, i.e. alternatives, Emilia could have cooked, such as *beef* or *fish*. Thus, the focal accent on the object introduces additional information, which go beyond the literal meaning, into the interpretation of the sentence.

Previous experimental research has provided evidence in support of the alternative semantics theory. Various studies have shown that alternatives for a focused element are indeed activated in the listener's mind and are thus real cognitive entities (e.g. Braun & Tagliapietra, 2010; Husband & Ferreira, 2015; Kim, 2012; Kim, Gunlogson, Tanenhaus & Runner, 2015; Gotzner 2015a, 2015b; Gotzner et al., 2016, Gotzner & Spalek, 2016; Byram Washburn, 2013).

However, one question previous research has left unanswered, is which specific elements are considered as alternatives and are thus part of the focus alternative set that is activated when processing a focused element. In this thesis, I aim at closing this knowledge gap by trying to answer this question.

There are two theories that make different claims about which elements are included in an alternative set, the permissive account by Rooth (1985, 1992) and the restrictive account by Wagner (2006, 2012)[3]. According to Rooth (1985, 1992), alternative sets are relatively broad, containing alternatives that match the focused element in their semantic type (to be able to replace them grammatically) and that are contextually relevant. A listener encountering the sentence *Ben bought [pink]$_F$ trousers* might thus generate an alternative set like *[black, blue, expensive, cheap, new, ripped]*, including all possible replacements for the focused adjective *pink*. Wagner (2006, 2012), however, claims that alternative sets are more restricted. While he agrees with Rooth on the necessity for alternatives to be of the same semantic type and contextually relevant, he postulates that in addition alternatives and the focused element need to be contrastive and mutually exclusive. In the mentioned example, Wagner would predict an alternative set like *[blue, black, white, grey, beige*]. As only other colour adjectives are contrastive to the focused element *pink* and satisfy the requirement of mutual exclusion, only they are considered to be true alternatives.

In this thesis, I will approach the discussion on the extent of alternatives from a psycholinguistic point of view. I will use experimental research to try to gain evidence in favour of

[3] I will follow Katzir (2013) and Gotzner (2015a, 2015b) in using the terms *permissive* and *restrictive*. However, neither Rooth (1985, 1992) nor Wagner (2006, 2012) used them to describe their theories.

either of the two theories, and thus come closer at answering the question of which particular elements are part of a set of focus alternatives.

The thesis is structured as follows: In Chapter 2, I will provide the theoretical background for my own experimental research. First, the notion of focus will be discussed in more detail by looking at how focus can be realised and discussing various attempts at defining focus. This leads to a detailed outline of the alternative semantics theory by Rooth (1985, 1992), whose definition of focus will serve as the theoretical foundation for this thesis (Chapter 2.1.1). After summarising pragmatic and semantic uses of focus (Chapter 2.1.2), I will outline the ongoing discussion on whether or not different types of focus (i.e. contrastive focus and information focus) need to be distinguished from one another (Chapter 2.1.3). In Chapter 2.2, I will move away from focus in general and look more closely at alternative sets. Here, I will explain the permissive theory by Rooth (1985, 1992) and the restrictive theory by Wagner (2006, 2012) in detail, discussing their similarities, their differences and the claims they make about the extent of alternative sets. Following this, a selection of studies that have conducted empirical research on alternative sets will be presented (Chapter 2.3). Outlining these studies will not only help to present the status quo of focus alternative research but also help to set the stage for my own experimental reserach which will be presented in the second half of this thesis (Chapter 3). After outlining the aims and the hypotheses of my study, I will provide a detailed description of the material, procedure and the results, before finishing the chapter with a discussion of the results with respect to the permissive and the restrictive account. The final chapter will comprise the general discussion and conclusion of this thesis. I will summarise the key findings of my study, discuss the implications of the results with regards to theories about alternative set and the current state of research.

2. Theoretical background

2.1 Focus

Linguistic focus is one core notion of information structure, which "provides comprehenders with information that could help guide the processing and interpretation of sentences" (Cowles, 2012, p. 293). There are a variety of ways with which focus can be realised in different languages, and even within one language there often are different means to do so (e.g. Büring, 2010; Zimmermann & Onéa, 2011). Focus can, for example, be expressed using phonological or phonetic means, such as pitch accents, lengthening/shortening or prosodic

phrasing (Féry & Ishihara, 2016). In examples (2), the adjective *own* is focused by pronouncing it with a pitch accent.

(2) Paula should mind her [own]$_F$ business.

Focus can also be realised morphologically, through morphological marking, or syntactically, by, for example, syntactically moving the focused element or using cleft-constructions (Féry & Ishihara, 2016), as illustrated in (3) and (4) retrospectively.

(3) [Bananen]$_F$ hat Lisa gekauft.
bananas has Lisa bought

(4) [It was the child]$_F$ who made everyone laugh.

(5) Maria only screamed at [Jacob]$_F$.

Additionally, speakers can make use of semantic and pragmatic means to realise focus, for example through the use of focus sensitive particles (as exemplified in (5)) or the manipulation of pragmatic implicatures (Féry & Ishihara, 2016; Büring, 2012).

Although one language might have a variety of ways to mark focus, it has been argued that each way might result in a slightly different interpretation of the information (Krifka, 2007). Cleft constructions, for example, seem to be necessarily entailing exhaustivity, while pure prosodic focus does not (e.g. Büring, 2012; Krifka & Musan, 2012).

On an intuitive level, focus seems to somehow highlight the most relevant or the newest information. The three terms 'highlighting', 'important' and 'new' have been frequently linked to linguistic focus (e.g. Halliday, 1967; Chomsky, 1970; Jackendoff, 1972). However, according to Krifka (2007), these explanations do not suffice when defining focus, as they cannot account for certain linguistic data. The definition that focus highlights the most important part of the conveyed information is not only lacking a clear explanation of what 'highlighting' actually means but is particularly unsatisfactory when considering sentences like (6), taken from Krifka (2007, p. 29).

(6) It wasn't [John]$_F$ who stole the cookie.

Krifka (2007) asks the question, why *John* should be considered as being the most important information in (6), when what seems to be really important is the fact that someone else than John stole the cookie. Question-answer scenarios like (7), on the other hand, seem to indicate that the focused element always corresponds to the newest bit of information, i.e. previously unknown information, thus apparently supporting the idea that focus is necessarily linked to newness. However, Krifka points out that "[t]here are many cases in which a constituent that refers to something previously mentioned is in focus" (2007, p. 29), as the example in (8) illustrates.

(7) a. What did Michael buy?

b. He bought [chocolate cake]$_F$.

(8) a. Where was Ben born, in England or Senegal?

b. He was born in [Senegal]$_F$.

In (8), not the country itself (or, to be more exact, the expression *Senegal*) is new but the fact that *Senegal* corresponds to the *x* in *He was born in x*, thus satisfying this description. So, while highlighting, importance and newness often correlate with focus, they are not appropriate concepts to define it (e.g. Krifka, 2007; Krifka & Musan, 2012).
That still leaves open the question of how to define focus.

One theory of focus is being supported by many theoretical linguistics as well as psycholinguists in at least its core principles (e.g. Krifka, 2007; Krifka & Musan, 2012; Wagner, 2006, 2012; Büring, 2007; Zimmermann & Onéa, 2011; Braun & Tagliapietra, 2010; Husband & Ferreira, 2015; Byram Washburn, 2013; Kim, 2012; Kim, Gunlogson, Tanenhaus & Runner, 2015; Gotzner, 2015a, 2015b; Gotzner et al., 2016) – Rooth's alternative semantics theory (1985, 1992)[4].

In the following chapter, I will outline the main characteristics of alternative semantics, which will then serve as the theoretical foundation for any further discussion of focus.

[4] One other well-known semantic theory of focus is the structured meanings account that essentially partitions an utterance containing a focused element into a background and the focus part. As the alternative semantics theory will serve as the theoretical foundation for this thesis, I will not further elaborate on the structured meanings account. For more details, see for example von Stechow (1982, 1990), Jacobs (1983) or Krifka (1991, 1995, 2001).

2.1.1 Focus in alternative semantics

The alternative semantics theory of focus was first introduced by Rooth in his doctoral dissertation in 1985, whose main aim was to propose a novel analysis of focus sensitive particles, such as *only* and *even*. In 1992, Rooth further developed his theory, adopting the term *alternative semantics*, first introduced by von Stechow (1989).

As mentioned in the introduction, according to alternative semantics, the main function of focus is to evoke alternatives to the focused element (Rooth, 1985, 1992). Rooth claims that there are two components to the meaning of a focused element, an ordinary semantic value and a focus semantic value[5]. The ordinary semantic value equates to the meaning of the focused element, might this be a word, a phrase or a clause, as derived by conventional compositional semantics. The focus semantic value is an additional semantic value added by focus. It corresponds to the set of elements that match the focused element in semantic type and that could substitute it in the given context, i.e. alternatives for the focused element. Consider Rooth's examples in (9) and (10) for clarification (Rooth, 1992, p. 76).

(9) a. Mary likes $[\text{Sue}]_F$

b. Ordinary semantic value: {like (Mary, Sue)}

c. Focus semantic value: {like (Mary, x) | x ε *E*}, where *E* is the domain of individuals.

(10) a. $[\text{Mary}]_F$ likes Sue.

b. Ordinary semantic value: {like (Mary, Sue)}

c. Focus semantic value: {like (y, Sue) | y ε *E*}, where *E* is the domain of individuals.

The ordinary semantic value of the sentences (9a) and (10a) are the same, a person called Mary likes another person called Sue[6], i.e. (9b) and (10b). However, the focus semantic value changes with the position of focus. The focus semantic value of (9a), where the object is focused, would correspond to (9c), *Mary likes x*. Here, x stands for all the possible people[7] Mary could like, including the focused element *Sue*. The focus semantic value of (10a), however, can be described as (10c), *y likes Sue*, where y stands for all the possible people that could like

[5] The focus semantic value is also sometimes referred to as alternative semantic value.

[6] I assume that both proper names belong to female humans. However, one could imagine a situation in which one of the two female names (or both) refers to, e.g. an animal.

[7] One could also use the word *entity* instead of people, if one wanted to broaden the alternative set (see footnote 6).

Sue, including the focused element *Mary*. Thus, the ordinary semantic value is a subset of the focus semantic value, from which it derived. Or, in Rooth's words (1992, p. 76):

> At an intuitive level, we think of the focus semantic value of a sentence as a set of alternatives from which the ordinary semantic value is drawn, or a set of propositions which potentially contrast with the ordinary semantic value.

Thus, bare prosodic focus has no effect on the sentence's truth condition. Whether or not it is true that Mary likes Sue depends on the facts, but it is independent of whether the subject or the object is focused (Rooth, 1985, 1992). So, it is true or false in both cases, (9a) and (10a). However, what does change is the listener's interpretation of the sentence, i.e. the pragmatic inferences that arise from the sentences (Rooth, 1992; Krifka, 2007). Explaining it informally, a listener hearing (9a), might infer that Mary only likes Sue but that she does not like any other person included in the alternative set (x), whereas the same listener might interpret (10a) as Mary being the only person who likes Sue, while no one else in (y) does. Thus, while the literal meaning is not affected by prosodic focus, the pragmatic inferences, which some might link to exhaustivity (e.g. Gotzner, 2015a), do. It is important to note, however, that this exhaustive implicature is not fixed and can be cancelled by additional information. In (10a), the speaker might add *Well, actually, Chris likes Sue as well*, without making the focus in (10a) infelicitous (Gotzner, 2015a). Therefore, exhaustivity can be the result of prosodic focus but it is not necessarily linked to it.

Although this thesis is mainly concerned with prosodic focus, it is important to mention that the effect of focus is not the same across all the different realisations of focus. Focus sensitive particles like *only* and *even*, for example, have an effect on a sentence's truth condition (Rooth, 1985). I will illustrate this using an example by Rooth (1985, p. 2).

(11) a. I only introduced $[\text{Bill}]_F$ to Sue.
b. I only introduced Bill to $[\text{Sue}]_F$.

In a situation where I introduced Bill and Tom to Sue but made no other introductions, (11a) is false, whereas (11b) is not. The exhaustive effect triggered by the exclusive particle *only*, cannot be cancelled, as it is part of the particle's meaning (Rooth, 1992; Gotzner, 2015a).

Therefore, a sentence with *only* does not have two readings, like the ones described for prosodic focus. Instead, the exclusion of alternatives for the focus element is necessarily linked to the particle, as it is lexically encoded (Rooth, 1992).

According to alternative semantics, focus alternatives can either be implied in the sentence, as in examples (9) and (10), or they can be explicitly stated in the context, like in (12).

(12) a. Where are you going to go on holiday this summer, Senegal or England?
b. We are going to [Senegal]$_{F.}$

In example (12a), the speaker explicitly names two alternatives, one of which is chosen by the speaker of the corresponding answer in (12b)[8]. However, if no alternatives are overt in the context but simply implied, "the speaker intends for the listeners to accommodate this [alternative set]" (Rooth, 2016, p. 22).

2.1.2 Pragmatic and semantic uses of focus

According to Krifka's theory of information structure (e.g. Krifka, 2007), which is based on the assumption that communication is a "continuous change of the common ground (CG)"[9] (Krifka, 2007, p. 13-14), one can distinguish two different kinds of uses of focus: the pragmatic uses and the semantic uses. Although this paper will mainly focus on pragmatic uses of focus, for the sake of completeness, I will give a brief overview of the main aspects of semantic uses of focus as well.

The pragmatic uses of focus are linked with the communicative goals of the interlocutors, i.e. in which direction the discourse is to develop. While pragmatically used focus does not directly affect a sentence's truth condition, as mentioned in the previous chapter, the inappropriate selection of focus can lead to communicational problems (Krifka, 2007).

The most common pragmatic use of focus, and for this paper the most relevant one, can be found in question-answer-scenarios. Here, focus is used to mark that part of the answer

[8] Interestingly, experimental research by Gotzner et al. (2016) suggests that additional alternatives are considered, even when a set of alternatives has been explicitly mentioned in the discourse. See Chapter 2.3.2 for more information on this matter.
[9] Here, common ground is understood as the mutually shared knowledge of the interlocutors in a particular discourse (e.g. Stalnacker 1973, 1974). See Krifka (2007) for a more detailed explanation.

which corresponds to the wh-constituent of the question (e.g. Paul, 1880; Krifka, 2007; Büring, 2012). Consider example (13) for clarification.

(13) a. Who broke the vase?

b. $[\text{Alwin}]_F$ broke it.

c. Question meaning according to Hamblin: $\{\text{BROKE(VASE)(X)} \mid x \in E \wedge \text{PERSON(x)}\}$

d. Ordinary semantic meaning of the answer: {BROKE(VASE)(ALVIN)}

e. Focus semantic meaning of the answer: $\{\text{BROKE(VASE)(x)} \mid x \in E \wedge \text{ENTITY(x)}\}$

The focused subject *Alwin* in (13b) corresponds to the wh-constituent *who* in the preceding question (13a). This observation highlights a link between alternative semantics and Hamblin's (1973) definition of what the meaning of questions are (Rooth, 1992; Krifka, 2007). Hamblin describes the meaning of questions as the set of propositions in all worlds that correspond to possible (congruent) answers (i.e. (13c)), or in Hamblin's words: "[Q]uestions set up a choice-situation between a set of propositions, namely those propositions that count as answers to it" (1973, p. 48). The actual answer (13b), i.e. the ordinary semantic value in alternative semantics (13d), is one of these propositions (Krifka, 2007). The whole set of propositions can be linked to the focus semantic value in alternative semantics. However, they are not equivalent. This can be derived from the difference between (13c) and (13e). While the question word *who* in (13a) requires the *x* in (13c) to be a person, this restriction does not apply in (13e) (Rooth, 1992; Krifka, 2007). According to alternative semantics, possible alternatives for *Alwin* might also be *the wind* or *the dog*, i.e. other entities that could have broken the vase. Therefore, the set of propositions which defines the meaning of the question constitutes a subset of the focus semantic value of the answer (Rooth, 1992). So, focus in answers and the preceding questions directly influence the development of the discourse and are thus clearly related to pragmatics.

Other pragmatic uses of focus are, for example, to correct or confirm information or to highlight parallels (Krifka, 2007)[10]. In (14b), focus is used to confirm the ordinary semantic

[10] Krifka (2007) also introduces 'delimitation' as another pragmatic use of focus. However, as Krifka mainly refers to contrastive topics in his explanation, this aspect is not of particular relevance for this thesis. Thus, I will not go into greater detail but refer the interested reader to Krifka (2007, p. 47ff).

value of (14a), after considering and excluding other possible alternatives[11]. In (14c), focus is used to correct the proposition in (14a), expressing that the ordinary semantic meaning of (14c) is the only true one (Krifka, 2007).

(14) a. Alwin broke the vase.

b. Yes, $[\text{Alvin}]_F$ broke the vase.

c. (No,) $[\text{Ben}]_F$ broke the vase.

(15) An $[\text{American}]_F$ farmer was talking to a $[\text{Canadian}]_F$ farmer…

Focus in parallel constructions is said to probably help the listener in constructing a mental model of the scenario (Krifka, 2007). In the much-quoted example in (15) (Rooth, 1992, p. 80), two overt alternatives are directly contrasted with each other. Here, Krifka argues that "parallel expressions are required to have the same set of alternatives" (2007, p. 24), which in the case of (15) would happen on a nominal level (Krifka, 2007; Rooth, 2016). Thus, the focus semantic value of both focused elements would be $\{P(\text{FARMER}) \mid P \in \text{NATIONALITY}\}$ (Krifka, 2007).

Semantic uses of focus are those in which a sentence's truth conditions change, as in the case of focus sensitive particles, briefly discussed in the previous chapter. Focus sensitive particles like *only*, *also* and *even* are said to associate with focus as their interpretation depends on an expression bearing focus (Rooth, 1985, 1992; Krifka, 2007). In example (16a), *only* associates with the focused object *Chris*, expressing that Susan does not like anyone else than Chris. However, the different position of focus in (16b) results in a very different meaning of the otherwise identical sentence. (16b) expresses that Susan likes Chris but does not love him.

(16) a. Susan only likes $[\text{Chris}]_{F.}$

b. Susan only $[\text{likes}]_F$ Chris.

Like with the pragmatic uses of focus, alternatives play a key role in the interpretation of sentences containing a focus sensitive particle. These particles express a certain relationship between the focused element and its contextually relevant alternatives (König, 1991). *Only* is

[11] This example again illustrates that newness is not necessarily linked to focus, as discussed in Chapter 2.1.

being defined as an exclusive particle, as it asserts that the focused element is the only one within the alternative set that leads to a true assertion, i.e. it is not true that Susan in (16a) likes anyone else but Chris. Additive particles like *also* presuppose that the assertion holds true for at least one other element of the alternative set besides the focused element. Example (17a) thus expresses that apart from Chris, Susan likes at least one other person. *Even*, as a scalar particle, is linked to a presupposition of likelihood. The alternatives are ordered on a scale of likelihood, and the focused element is very low (maybe even the lowest one) on this scale (König, 1991). So (17b) expresses that Chris is a very unlikely or the least likely person Susan would like.

(17) a. Susan also likes $[\text{Chris}]_F$

b. Susan even likes $[\text{Chris}]_F$

Therefore, one could summarise that while pragmatic uses of focus (e.g. prosodic focus in answers) indicate the existence of alternatives for a focused element, semantic uses of focus (e.g. focus sensitive particles) more specifically express a certain relationship between the focused element and its alternatives.

2.1.3 Information focus and contrastive focus

According to Rooth's alternative semantics, an element is said to be focused when alternatives to the focused elements are evoked and are part of the interpretation of the utterance. However, Rooth (1985, 1992) does not mention anything specific about the different realisations of focus, making the alternative semantics theory compatible with a variety of realisations (Krifka, 2007).

However, there is a long-standing discussion on whether this definition of focus is actually applicable to the same degree to different types of focus, such as information focus[12] and contrastive focus, or whether these two need to be distinguished grammatically.

[12] Information focus is also known under the term presentational focus (e.g. Selkirk, 2002). Some other researchers avoid using the term *focus* altogether, and refer to these kinds of elements as discourse-new (e.g. Rochemont, 2013; Katz & Selkirk, 2011).

Information focus is generally defined as that part of the utterance which introduces new information into the discourse, i.e. previously not shared by the speaker and his interlocutor(s) (e.g. Jackendoff, 1972; Rochemont, 2013; Zimmermann & Onéa, 2011)[13].

Information focus is most commonly found in answers. Here, as previously mentioned, the focused element corresponds to the wh-constituent of the question, i.e. it is the part of the information that was asked for. However, when information focus occurs without an overt question, one could assume that focus might indicate covert questions (e.g. Roberts, 1996; Büring, 2003, 2012) that the addressee can accommodate from the context. Covert questions for (18a) and (18b) could be *Who spilled the coffee?,* and *What did he buy?,* retrospectively.

(18) a. $[\text{Laura}]_F$ spilled the coffee

b. He bought a $[\text{gun}]_F$

Here, focus is used to indicate the existence of alternatives for the focused element, namely other possible elements that could correspond to the wh-constituent.

Contrastive focus, on the other hand, can be defined as being used to juxtapose the focused element with one (or more) other elements that are overt in the discourse (e.g. Zimmermann & Onéa, 2011). Consider examples (19) to (21) for clarification.

(19) a. You like $[\text{Jess}]_F$?

b. No, I like $[\text{Katherine}]_{F.}$

(20) I didn't break the $[\text{mug}]_F$, but I did break the $[\text{glass}]_{F.}$

(21) a. Who did you invite? (Zimmermann, 2007, p. 147)

b. $[\text{Paul}]_F$, I invited (but nobody else).

In (19), the contrastive focus is used in a corrective way, i.e. indicating that the focused object *Katherine* is the element that leads to a true proposition, while the previously named

[13] Krifka (2007) argues against this simplified definition of information focus, as there are instances where the focused element was mentioned in the previous discourse, as mentioned in Chapter 2.1. His point is illustrated again in example (i) (Krifka, 2007, p. 29).

(i) A: Who stole the cookie, John or Mary?

B: $[\text{John}]_F$ stole the cookie.

Krifka explains that it is "shared information in [(i)] that John or Mary stole the cookie. The difference to what the sentence says (…) is a more specific proposition" (2007, p. 29).

alternative *Jess* does not. In (20), the two alternatives *glass* and *mug* are used in a contrastive statement, and in (21b) contrastive focus is used to indicate the answer's exhaustivity (Zimmermann, 2007).

In the last three examples, the focused elements are directly contrasted to (some of) their overt alternatives, while the alternatives are not explicitly mentioned in the case of information focus (e.g. Zimmermann & Onéa, 2011; Krifka, 2007; Repp, 2010). So, the interpretation of both types of focus is necessarily linked to corresponding alternatives. However, the relationship between the focused element and its alternatives differs. While information focus seems to implicitly presuppose alternatives but "otherwise imposes no restrictions on how the alternatives are evaluated" (Repp, 2010, p. 1337), contrastive focus expresses a specific relationship between the focused element and its overtly named alternatives, i.e. if one is substituted by another, the proposition becomes false (Repp, 2010).

However, this interpretation of the different types of focus is not undisputed (e.g. Vallduví & Vilkuna, 1998; É.Kiss, 1998; Rochemont, 1986, 2013; Katz & Selkirk, 2011). There is an ongoing discussion on whether information focus actually depends on the existence of alternatives or if this necessity is only linked to contrastive focus. As a full outline of the ongoing discussion would go beyond the scope of this thesis (see Rochemont (2013) for a more detailed overview of this debate), only the for this thesis relevant part of the discussion concerning the phonological realisation of focus will be discussed (e.g. Pierrehumbert & Hirschberg, 1990; Selkirk, 2008; Katz & Selkirk, 2011).

There is no dispute about the fact that both types of focus are marked by a pitch accent in spoken speech in English and German. However, what is under discussion is whether information focus and contrastive focus are associated with different kinds of pitch accents, which could reflect a grammatical distinction between the two. According to Pierrehumbert (1980), accent types can be categorised into high (H) and low (L) targets. In the ToBI labelling system[14] (e.g. Silverman et al., 1992), the H* pitch accent would therefore consist of a single high target on the accented syllable, whereas the L+H* accent first contains a low target followed by steep rise in pitch on the accented syllable (Pierrehumbert, 1980; Pierrehumbert & Hirschberg,

[14] The adaptation of the ToBI (Tones and Break Indices) labelling system for German is called German Tones and Break Indices (GToBI). For more details, see e.g. Grice & Baumann, 2002.

1990). Pierrehumbert and Hirschberg (1990) claim that these two accent types are directly linked with information focus and contrastive focus, i.e. that there is a one-to-one correspondence between a specific realisation and focus type (see e.g. Watson, Gunlogson & Tanenhaus (2008) for a more detailed discussion).

While there is some evidence in favour of this distinction, not all studies confirm this seemingly simple division. Some prosodic studies suggest that contrastive accents have a longer duration and intensity, as well as a higher pitch than non-contrastive accents, i.e. information focus accent (Selkirk, 2002; Katz & Selkirk, 2011). However, other studies have shown that speakers often do not systematically differentiate between the two types, unless the task pointed out the necessity to indicate focus types (e.g. Breen, Fedorenko, Wagner & Gibson, 2010). While some perception studies suggest that L+H* elements are perceived as more prominent and contrastive than H* ones (e.g. Ito & Speer, 2008), others have shown that listeners are unable to consistently distinguish between the two types of accent (e.g. Alter, Mleinek, Rohe, Steube & Umbach, 2001; Breen et al., 2010).

Therefore, neither production nor perception studies provide consistent evidence that speakers and listeners systematically distinguish between the two types of accents, which does not seem to support the claim that different focal accents are necessarily linked to different interpretations. But even if listeners and speakers would consistently distinguish between the two, it would still be under discussion, "whether this difference is only gradual (Bolinger, 1961; Alter et al., 2001) or categorical in nature (Katz and Selkirk, 2009)" (Zimmermann & Onéa, 2011, p. 1664). Thus, one might assume that information focus and contrastive focus are two sides of the same coin, i.e. both being subtypes of focus that are expressed by two variants of the same pitch accent.

Therefore, I follow Bolinger (1961), Jackendoff (1972), Gussenhoven (2004), Schwarzschild (1999), Krifka (2007), Büring (2007), Zimmermann and Onéa (2011), and others in assuming that both focus types belong to the same information structural category – focus. Most importantly, Rooth (1985, 1992) applies his alternative semantics theory to both types of focus. As the theoretical foundation of this thesis is based on alternative semantics, I adopt the interpretation that both types of focus, information focus and contrastive focus, are necessarily linked with the introduction of alternatives into the discourse, as mentioned at the start of this chapter. Thus, in line with Rooth (1985, 1992), I will no longer distinguish between information focus and contrastive focus in this thesis, unless it is of particular relevance.

After defining how focus is understood in this thesis, I will now discuss alternative sets in more detail by outlining two theories that make different assertions regarding the extent of alternative sets.

2.2 The extent of alternative sets

As one seems to automatically consider a set of alternatives when computing a sentence including a focused element, the question arises which particular elements belong to this alternative set. As mentioned in the introduction, there are two opposing theories discussing this matter, the permissive account by Rooth (1985, 1992) and the restrictive account by Wagner (2006, 2012). While Wagner builds upon Rooth's alternative semantics theory, the two make different claims about the extent of alternative sets (see also Katzir (2013) for a comparison of the two). In the following, I will outline both theories in more detail with regards to the size of alternative sets[15] to provide the theoretical foundation for my experimental research (Chapter 3).

2.2.1 The permissive account

In Chapter 2.1.1, I already outlined the essential aspects of the alternative semantics theory by Rooth (1985, 1992). In this chapter, I will explain in more detail which claims the theory makes about the extent of alternative sets.

According to alternative semantics, only elements that match the focused element in (semantic) type and that are not identical to it are considered to be alternatives. Thus, if the focused element is, for example, a transitive verb of the type <e, et>, only elements of the same type would be possible alternatives. However, Rooth points out the necessity to restrict the alternative set in some way, as always using "the full semantic value (…) is unsustainable" (1992, p. 78).

In his framework, Rooth further restricts the alternative sets by introducing the variable C. The value of this covert variable is not semantically fixed but depends on pragmatic processes and context (Rooth, 1992). Rooth explains: "Part of what is involved in understanding

[15] Please note that I will only outline those aspects of the two accounts that are essential for the question discussed in this paper, while drastically shortening or omitting other aspects of the theories. The interested reader is advised to read the original publications by Rooth (1985, 1992) and Wagner (2006, 2012) to get a full grasp of their work.

[a sentence containing focus] is recovering from context (or constructing) a set of relevant properties which are to be considered substitutes (…)" (1992, p. 79). Thus, C is constrained by the focus semantic value and further restricted by context, making it a subset of the focus semantic value, which contains a smaller set of alternatives that are relevant in the given context. Rooth (1985) bases the contextual restriction of alternative sets entirely upon pragmatic processes, without specifying which underlying factors or mechanism could distinguish between contextually appropriate and contextually inappropriate replacements. However, in his 1992 paper, Rooth gives an example to illustrate how these pragmatic processes might construct a domain of quantification.

(22) Mary only $[\text{read}]_F$ *The Recognitions*. (Rooth, 1992, p. 79)

In (22), the focused element is a transitive verb that describes a certain relation between the subject and the object, namely that Mary has read the book *The Recognitions*. Rooth (1992) explains that applying the whole focus semantic value would lead to inappropriate truth conditions (i.e. inappropriate relations between the subject and object, like e.g. *Mary ate The Recognitions)*. Instead, context restricts C to only two elements, *read* and *understand*. Based on this example, I therefore interpret Rooth's variable C as being bound or restricted by world knowledge, a point that I will elaborate on using example (23).

(23) a. In the desert, Mark photographed a wild $[\text{mouse}]_F$
Possible set of alternatives: {snake, camel, meerkat}
b. In the rainforest, Mark photographed a wild $[\text{mouse}]_F$
Possible set of alternatives: {snake, orangutan, toucan}

In my interpretation of the permissive account with regards to the contextual restriction, the focused noun *mouse* in (23a) might elicit alternatives such as *snake, camel* or *meerkat*, while the same focused noun in a different context, such as the one in (23b), might evoke alternatives like *snake, orangutan* or *toucan*. While *orangutan* and *toucan* are possible substitutes for *mouse* in (23b), they do not seem appropriate in (23a), as our world knowledge tells us that these animals do not live wildly in the desert. The same is true for *camel* and *meerkat.* These nouns are part of the alternative set for (23a) but not for (23b), as these animals should

not be wildly found in the rainforest. Of course, one might be able to think of a situation in which a camel or a meerkat can be found in the rainforest (e.g. broke out of a zoo etc.). However, under normal circumstances, i.e. according to our world knowledge, this should not be the case. These examples exemplify my interpretation of Rooth's proposal, namely that the members of an alternative set depend not only on the focused element itself, but also on the context it appears in[16].

To summarise, according to Rooth (1985, 1992), alternatives need to be of the same semantic type as the focused element, they need to be distinct from it, and they need to be contextually appropriate replacements for it. Thus, as "the allowable replacements for a focused constituent are a large and non-discriminative set" (Katzir, 2013, p. 335), Rooth's theory is referred to as a permissive theory on the extent of alternative sets.

2.2.2 The restrictive account

Wagner (2006, 2012) presents a more restricted view on the extent of focus alternative sets as part of his discussion of givenness[17]. While Wagner agrees with the main claim of alternative semantics, namely that the main function of focus is to introduce relevant alternatives for the focused element into the discourse, he disagrees with the permissiveness of Rooth's theory with regards to the extent of alternative sets. On the basis of examples like (24), he claims that certain 'Rooth alternatives' (i.e. alternatives according to the permissive account by Rooth (1985, 1992)) are in fact excluded from the alternative sets and are thus no true alternatives.

(24) a. Mary only likes $[\text{red}]_F$ convertibles. (Wagner, 2006, p. 297)
b. Mary likes blue convertibles.
c. Mary likes high-end convertibles.

According to Wagner (2006, 2012), the sentence in (24a) automatically negates (24b), as Mary cannot like blue convertibles if she only likes red ones. However, (24a) does not rule out (24c), as (24a) does not seem to imply anything about the price or quality of the convertibles

[16] See Kim (2012) and Kim et al. (2015) for experimental research on the role of context in focus interpretation.
[17] Please note that Wagner first mentioned part of his restrictive view in his doctoral dissertation in 2005.

Mary likes. She could like red convertibles that are high-end or cheap, (24a) does not provide information in this regard. Thus, *high-end* seems to be ignored as a possible replacement for *red*. Wagner (2006, 2012) argues that in example (24) only *blue* is a true alternative for the focused element *red*, because these two are contrastive and mutually exclusive (if one is true, the other one cannot be true). *High-end*, on the other hand, is not a true alternative for the focused adjective *red* in this context, as the two elements do not negate one another.

Thus, Wagner infers that elements need to be contrastive and mutually exclusive to be part of an alternative set, therefore restricting alternative sets to a much greater degree than Rooth (1985, 1992), who would have considered *red*, *blue* and *high-end* to be part of the alternative set. Consequently, the permissive account allows alternatives to not be semantically related with the focused element and to be from different taxonomic categories, while this is not the case according to the restrictive view. For two elements to be mutually exclusive in a certain context, the two need to be part of the same semantic network.

As outlined in the previous chapter, Rooth (1985, 1992) assumes that alternative sets are restricted by context. Wagner (2006, 2012), too, postulates the importance of context for the establishment of alternative sets, and specifically highlights the dependency of alternatives for an adjective on the head noun. Considered example (25) (Wagner, 2006, p. 302-303)

(25) a. She has a $[\text{new}]_F$ bicycle.
Possible set of alternatives: {old, former, used}
b. She has a $[\text{new}]_F$ boyfriend.
Possible set of alternatives: {old, former, #used}

In (25a), a possible alternative set for the focused adjective *new* might be *old*, *former* and *used*. However, when the same adjective occurs with a different head-noun, like in (25b), the adjective *used* is no longer a valid alternative to *new* because *used* is not an appropriate adjective to describe boyfriends, “since they are no[t] usually understood as a commodity that one can possess and sell” (Wagner, 2006, p. 303).

Thus, according to my interpretation of Rooth’s (1985, 1992) and Wagner’s (2006, 2012) account, both agree on context being an important influencing factor on the establishment of alternative sets, while disagreeing on the members of the set itself.

Interestingly, while both theories claim that context is a restricting factor for the extent of alternative set, the two accounts differ in the way that listeners could use the context to make predictions about the upcoming referent and the related alternative set. The permissive account seems to allow comprehenders to generate an initial set of alternatives before the focused element was actually introduced into the discourse. A listener might be able to generate an alternative set for (26b) such as *[modern, big, small, wooden, beautiful, ugly (…)*] on the sole basis of the corresponding question in (26a).

(26) a. What kind of house did Jack buy?

b. He bought an $[old]_F$ house

(27) Jack's house is …

The same holds true for utterances like (27), if the prosodic structure of the unfinished sentence allows the speaker to predict that the last constituent is focused. If a listener evaluates the syntactic structure, the meaning as well as the prosodic structure of the (unfinished) sentence, he might be able to predict that the upcoming referent is an adjective, and generate an initial alternative set like [*modern, old, beautiful, ugly, big, small (…)*] based on this knowledge.

However, according to the restrictive account this is not possible. Here, listeners have to know the focused element to generate the corresponding set of alternative, as only those elements are alternatives which are contrastive to the focused element, and were both are mutually exclusive. The unfinished sentence in (27) or the question in (26a) do not contain enough information to predict the set of alternatives because this would vary according to the actual focused adjective, as illustrated in (28).

(28) a. He bought an $[old]_F$ house.

Possible set of alternatives: [modern, newly-build]

b. He bought a $[big]_F$ house.

Possible set of alternatives: [small, tiny]

Nevertheless, it is likely that listeners do make predictions about the upcoming referent and the corresponding set of alternatives but that the actual alternative set and the predicted set simply do not equate.

These differences seem to be linked to how the alternative sets of each theory relate to Hamblin's set of propositions (1973) that corresponds to the meaning of the question (as discussed in Chapter 2.1.2). While the permissive alternative set, i.e. the focus semantic value restricted by context, is a superset of Hamblin's set of propositions, the restrictive set is a subset of Hamblin's set of propositions.

However, what is particularly important for this thesis is that the permissive and the restrictive alternative sets overlap, as illustrated in Figure I. All elements of the restrictive alternative set are also alternatives of the permissive set, making the restrictive alternative set a subset of the permissive alternative set.

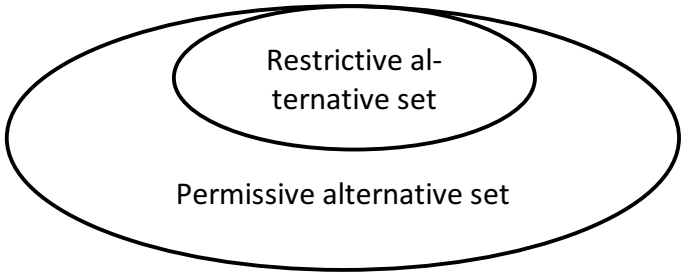

Figure 1: Illustration of the relation between the permissive and the restrictive alternative set.

2.3 Previous psycholinguistic research on focus alternatives

In the previous chapters, I have argued that the main function of focus is to indicate the existence of contextually relevant alternatives for the focused element. This assumption is the main claim of alternative semantics. This formal semantics account of focus, however, does not necessarily provide any information about the actual computation of focus or its underlying cognitive processes. What does it mean when we say that a listener 'entertains' a set of focus alternatives or that he 'considers' them as part of the sentence's interpretation? While some older research has shown that focus affects the processing of sentences through guiding the listener's attention (Cutler & Fodor, 1979) and eye movements during silent reading (e.g. Birch & Rayner, 1995, 2010) as well as guiding ambiguity resolution (e.g. Almor, 1999; Almor

& Eimas, 2008) and ellipsis processing (e.g. Carlson, Walsh Dickey, Frazier & Clifton, 2009)[18], more recent research specifically looked at focus alternatives.

In this chapter, I will provide an overview of some previous studies that investigated the status, representation and the processing of focus alternatives. The psycholinguistic studies discussed here will not only present the status quo of focus alternative research but will also lay the ground work for my own experimental research (Chapter 3). In the following, I will discuss two studies that provide evidence that bare prosodic focus activates a set of focus alternatives. Apart from describing the experiments and outlining the key findings of the studies, I will also discuss their results in light of the permissive and restrictive account. This brief analysis will be based on the information provided by the authors (results and list of items), but will not include a statistical analysis, as this would require access to the studies' data. In Chapter 2.3.2, I will then discuss studies on focus sensitive particles that provide evidence that the activation of alternative sets is not limited to bare prosodic focus.

2.3.1. Studies on bare prosodic focus and alternative sets

In a pioneering study, Braun and Tagliapietra (2010) investigated whether focus alternatives are cognitively real[19]. More specifically, in two cross-modal priming paradigm experiments they examined whether contrastive pitch accents alone create representations of these focus alternatives. The participants were first presented an auditory sentence with either a neutral intonation or a double contrast, i.e. a sentence containing two contrastively accented words, the second one being the prime word in final position, as illustrated in example (29) (Braun and Tagliapietra, 2010, p. 1041)[20].

(29) a. Related Prime: *In [Florida]$_F$ he photographed a [flamingo]$_F$*

b. Unrelated Prime: *In [Florida]$_F$ he photographed a [celebrity]$_F$*

c. Contrastive associate: *pelican*

d. Non-contrastive associate: *pink*

[18] The interested reader is referred to Cowles (2012) for a detailed overview of the effect of focus on language processing and language production.

[19] Braun and Tagliapietra (2010) built on an earlier study by Norris, Cutler, McQueen & Butterfield (2006).

[20] In fact, each sentence containing a contrastive intonation was preceded by a contrastive precursor and connector, as illustrated in example (ii) (Braun & Tagliapietra, 2010, p. 1032).
(ii): [We]$_F$ assembled a [satellite dish]$_F$, but [our neighbours]$_F$ assembled an [antenna]$_F$.

Participants then had to perform a lexical decision task on a visually presented target word, meaning they had to indicate by pressing a button whether the presented word was a real word of Dutch or not. In experiment 1a, the target words were either a contrastive associate to the related prime word (example (29): *pelican*), i.e. a possible alternative, or unrelated to the control prime (example (29): *celebrity*). In experiment 1b, the targets were either a generic, non-contrastive associate to the related prime word (example (29): *pink*), i.e. no possible alternative, or, again, unrelated to the control prime (example (29): *celebrity*).

The rationale behind this experimental paradigm is that if a target word is an alternative to the focused prime word, i.e. part of its alternative set, it should be activated when computing the focused adjective. This activation should then positively affect the subsequent lexical decision task, meaning that an alternative should be recognised faster as being a real word than an unrelated target.

Building on this, the authors predicted that contrastive associates should be recognised faster than unrelated targets when hearing the sentence with contrastive intonation than with neutral intonation. However, the recognition of the non-contrastive associates should not be affected by the contrastive intonation, as they are no alternatives for the prime word and thus should not be more activated when hearing the prime word with a contrastive pitch accent than when hearing it with a neutral intonation. If both types of associates were to be affected by the contrastive intonation, one could assume that focus activates all kinds of associates, not only a set of focus alternatives. The results were in line with the authors first predictions. Contrastive associates were recognised faster when being related to the prime word than when being unrelated, but only when the prime word was presented with a contrastive intonation. Non-contrastive associates were recognised slightly faster when being related to the prime word than when being unrelated. However, this facilitation occurred in both prosodic conditions, suggesting that non-contrastive associates are not influenced by contrastive intonation.

Braun and Tagliapietra concluded that contrastive associates were facilitated by the contrastive intonation because they are part of the alternative set that is activated when processing the focused prime word. Non-contrastive associates, on the other hand, were not particularly facilitated by the contrastive intonation because they are no alternatives for the focused prime word and are thus not activated when processing it. Thus, Braun and Tagliapietra

(2010) were the first to show that during the processing of bare prosodic focus alternatives for the focused element are activated in listeners' minds.

The results seem to support both theories on alternative sets, the permissive and the restrictive account, as both would predict the contrastive associate *pelican* to be an alternative for the prime word *flamingo*, while the non-contrastive associate *pink* would not be considered an alternative, as it has a different semantic type and would thus not be a possible substitute for the prime word.

It is important to mention, however, that the authors used the term 'non-contrastive' for a relatively broad and heterogeneous group of target words. A closer look at all of the items provided by Braun and Tagliapietra (2010) revealed that 18 out of the 35 non-contrastive targets were in fact possible alternatives according to permissive account, i.e. they were of the same semantic type as the prime word, contextually relevant but not contrastive (see Appendix A, Table A1 for a list of these items). Thus, one could interpret the results of the study as providing some initial support for the restrictive account by Wagner (2006, 2012), as the 51.4% of the non-contrastive associates that actually were alternatives according to the permissive account by Rooth (1985, 1992), were not particularly facilitated by the contrastive intonation and thus did not seem to be part of the alternative set for the focused element.

Husband and Ferreira (2015) followed up on Braun and Tagliapietra (2010), investigating the time line of and mechanisms related to the establishment of alternative sets. In two cross-modal priming paradigm experiments they compared the activation of contrastive and non-contrastive associates, using two different stimulus onset asynchronies (SOA) to observe how alternative sets are established over time. In experiment 1a, participants were first presented an auditory stimulus containing the prime word, which was either pronounced in a neutral or a contrastive pitch accent (see exmaple (30); Husband & Ferreira, 2015, p. 18).

(30) a. The museum thrilled the [sculptor]$_F$ when they called about his work.
b. Contrastive associate: *painter*
c. Non-contrastive associate: *statue*
d. Unrelated target: *register*

With an SOA of 0 ms, participants were presented a written target word, on which they had to perform a lexical decision task. The target word was either a contrastive associate to

the prime word (30b), a non-contrastive associate (30c) or an unrelated target word (30d). The results show that participants recognised contrastive associates faster compared to unrelated targets in both prosodic conditions. Non-contrastive associates were only recognised faster in the contrastive intonation condition. The authors conclude that contrastively focused words initially activate contrastive and non-contrastive associates, and assume that the lack of activation of non-contrastive associates in the neutral intonation condition might be due to a weaker semantic relatedness to the sentence context and possibly due to temporal aspects (see Husband & Ferreira, 2015, p. 8-9).

Experiment 1b, which was conducted to investigate the later stage of the processing, was identical to experiment 1a, except that the written targets were now presented with an SOA of 750 ms. The results show that contrastive associates were again recognised faster than unrelated targets in both prosody conditions, while the non-contrastive associates were only recognised faster in the neutral prosody condition. Hence, the contrastive-accenting of the prime word only affected contrastive associates. Husband and Ferreira (2015) argue that this effect suggests that only contrastive associates are considered as alternatives for the focused element. They conclude that listeners initially consider a broad set of associates but later only select those associates that are contrastive to the focused word, i.e. those, that form the true set of focus alternatives. According to the authors, the non-contrastive associates are rejected at this stage, either by active suppression or activation decay.

Although the underlying mechanism is still unknown, the study by Husband and Ferreira (2015) suggests that any mechanism restricting the alternative set seems to take time to come into effect.

Interestingly, the results of the study (experiment 1a) are not in line with what the permissive or the restrictive account would have predicted. A close look at the experimental items (Husband & Ferreira, 2015, p. 18-19) revealed that 85.9 % of the non-contrastive associates are no alternatives for the prime word according to the permissive and the restrictive account because they either were of a different semantic type as the prime word or were contextually not appropriate (see Appendix A, Table A2 and A3 for a list of these items). Thus, in experiment 1a, these associates should not have been activated, as they are not part of the alternative set. Therefore, one could argue that the observed facilitation of these items was due to general semantic priming. However, a statistical verification would be necessary to make any claim sustainable.

Comparing the two studies, there are obvious differences between the results of Braun and Tagliapietra (2010) and Husband and Ferreira (2015). On the one hand, Braun and Tagliapietra (2010) only found a facilitation effect for contrastive associates in the contrastive intonation condition, while Husband and Ferreira (2015) found this effect in both prosodic conditions at the early stage of focus processing. On the other hand, the non-contrastive associates in the study by Braun and Tagliapietra (2010) were facilitated in both prosodic conditions, while this effect was only observable in the contrastive intonation condition in experiment 1a and in the neutral prosody condition in experiment 1b in the study by Husband and Ferreira (2015). Crucially, these different results let to different interpretations and assumptions of the establishment of alternative sets. While Braun and Tagliapietra (2010) inferred that non-contrastive associates are not affected by contrastive intonation as they are not part of the alternative set, Husband and Ferreira (2015) argue that non-contrastive associates and contrastive associates are initially considered for the alternative set before the non-contrastive associates are rejected, leaving the contrastive associates as true members of the alternative set. Gotzner summarises these differences by saying that "this might suggest that a part of the mechanisms of focus is to suppress non-contrastive meanings on Husband and Ferreira's account while Braun and Tagliapietra (2010) do not reserve any special function of focus on the representation of non-contrastive elements" (2015a, p. 26). The different results of the two studies are likely to be due to methodological differences, like different positions of the prime word (sentence final vs. mid-sentence), different intonation contours (double contrast vs. single contrast) and different sentence structure (two contrastive sentences connected by contrastive connector vs. simple sentence). However, both studies seem to provide evidence that a possible substitute for a prime word is more accessible when the prime word is realised in a contrastive focus accent. Thus, prosodic focus alone seems to create representations of alternatives for a focused element during online language processing.

2.3.2 Studies on focus sensitive particles and alternative sets

Besides bare prosodic focus, some research also investigated the establishment of alternative sets for sentences containing focus sensitive particles.

Gotzner et al. (2016) explored whether listeners consider previously unmentioned alternatives for a focused element, when they are already provided with an explicitly named set of (contrastive) alternatives in the discourse. Participants were first presented a short auditory

discourse (*There is water, coke, and juice available at the drinks cash-and-carry. I bet Angelika bought juice and water.),* which contained three elements that were contrastive alternatives for one another (*water, coke, juice*). The following critical sentence was presented in one of three conditions (*No, she _ / only / even bought coke*.), either containing a focus particle, *only* or *even*, as well the focused prime word (*coke)*, or containing the focused prime word without a particle. Participants then saw a written target word with an SOA of 2050 ms that was either a previously mentioned alternative (*juice*), a previously unmentioned alternative (*tea*) or an unrelated target word (*plates*).

In the first experiment, participants had to indicate whether the target word was part of the previous discourse or not (probe recognition task). The results showed that participants reacted fastest for unrelated targets, slower for unmentioned alternatives and slowest for mentioned alternatives. Moreover, the existence of a particle decreased the reaction time for the unmentioned and the mentioned alternative further.

The second experiment was identical to experiment one, with the exception that participants now had to perform a lexical decision task instead of a probe recognition task[21], thus now confirming rather than rejecting targets. Gotzner et al. (2016) found the reversed reaction time pattern to experiment one: Mentioned alternatives were recognised fastest, unmentioned alternatives slower and unrelated targets slowest, in both, the particle and no-particle condition. However, participants recognised all targets slower in the particle than in the no-particle condition. Gotzner et al. (2016) conclude that listeners activate unmentioned alternative as well as mentioned alternative for a focused element, and that focus sensitive particles increase the competition among those alternatives, resulting in an interference effect that causes slower reaction times.

This study therefore shows that focus sensitive particles have a different effect on the recognition of alternatives than pure prosodic focus, possibly because of the more complex semantics linked to focus sensitive particles (Gotzner et al., 2016).

Gotzner (2015b) presented a novel analysis of the unrelated target words used in Gotzner et al. (2016), in order to investigate whether the permissive or the restrictive account

[21] In fact, there was one more difference between the two experiments. While experiment one contained three critical condition (*only*, *even*, no particle), experiment two only contained two conditions (*only*, no particle). According to Gotzner et al. (2016), this change was made as no significant difference was found between the two particle conditions in experiment one.

would have predicted the findings. Thus, Gotzner (2015b) aimed at answering a similar question to the one discussed in this paper. She divided the unrelated targets into two groups, those that are possible replacements for the prime word according to the permissive account (but not the restrictive account) and those that were no replacements. Gotzner (2015b) then included this additional factor in the analysis of the data collected in experiment two described in Gotzner et al. (2016). For the unrelated non-replacements, she predicted the same pattern found in her previous analysis (Gotzner et al., 2016), i.e. that unrelated items are recognised slowest, unmentioned alternative faster and mentioned alternative fastest. For the unrelated items that were possible replacements for the prime according to the permissive account, there were two hypotheses. The permissive account would predict these targets to be activated and recognised similarly fast as the unmentioned alternatives, as they were alternatives to the prime word and thus part of the alternative set. The restrictive account, on the other hand, would predict these targets to be recognised slower than the unmentioned targets, as they are no alternatives and thus should not receive the same amount of activation as unmentioned alternatives.

Gotzner (2015b) found no significant difference in the particle and no-particle condition for the reaction times of unmentioned alternatives and unrelated possible replacements, and thus infers that both groups of targets were activated when processing the focused prime word. However, this was not the case for the unrelated non-replacements, as these were recognised significantly slower. The author concludes that the group of unrelated possible replacements were considered as part of the alternative set and thus argues in favour of a broader set of alternatives in line with the permissive account, which would have predicted these findings. However, Gotzner (2015b) highlights the importance of context and its restrictive role in the establishment of alternative sets, referring to the finding of Kim (2012) and Kim et al. (2015).

In a series of eye-tracking experiments, Kim (2012) investigated how context influences the prediction of an upcoming focused element in sentences containing a focus sensitive particle (see also Kim et al., 2015). She found that the exclusive particle *only* allowed listeners to predict an upcoming focused element better than when no particle was present, as listeners seem to generate a set of semantically related alternatives on the basis of alternatives found in the context (e.g. *Mark has some pears and some oranges. Jane only / _ has some [apples]*$_F$). In another experiment, Kim (2012) found that the context setting has a direct influence on

which members are considered to be part of an alternative set. Listeners were better at predicting the upcoming focused word *magazines* in the narrow context condition (31b) than in the wide context condition (31a), but only when the focus particle *only* was present.

(31) **a. Wide context**

Jill and Peter are at the drugstore.

Jill is getting some cigarettes and some gum.

Peter is only/_ getting some [magazines]$_F$

b. Narrow context

Jill and Peter are at the newsstand.

Jill is getting some cigarettes and some gum.

Peter is only /_ getting some [magazines]$_F$

These results suggest that listeners create situation-based alternative sets. While listeners did not predict the target word *magazines* to be part of the alternative set in the wide context condition that included the two objects *cigarettes* and *gum*, the same two objects in combination with the narrow context, i.e. being at a newsstand, allowed listeners to predict the target as being part of the alternative set in (31b). Thus, the findings by Kim (2012) indicate that comprehenders rapidly integrate information provided by the context to establish alternative sets (see also Byram Washburn, 2013).

2.3.3 Summary of previous psycholinguistic research

The two studies outlined in Chapter 2.3.1 provided evidence that during the processing of bare prosodic focus listeners entertain a cognitively real set of alternatives. Braun and Tagliapietra (2010) and Husband and Ferreira (2015) both come to the conclusion that the true set of focus alternatives only contains contrastive alternatives for the focused element. However, as mentioned earlier, each study used a very heterogeneous set of non-contrastive items that included words that were either 1. grammatically and contextually appropriate replacements for the focused element, 2. grammatically but not contextually possible replacements, and 3. grammatically no possible replacement but were semantically related to the focused element. Thus, these studies provide evidence that elements which are considered alterna-

tives according to the restrictive account by Wagner are part of the alternative set. The question that remains unanswered is whether the alternative set is restricted to these alternatives or if it also includes elements that are considered alternatives by Rooth's permissive account, i.e. grammatically and contextually appropriate replacements that are not contrastive. While my own brief analysis of the results by Braun and Tagliapietra could be interpreted as the study initially supporting Wagner's restrictive theory (2006, 2012), this claim is weak due to the missing statistical verification.

Multiple conclusions can be drawn from the study by Gotzner et al. (2016). On the one hand, it shows that alternative sets are being activated upon hearing sentences containing a focus particles (see also Byram Washburn, 2013; Gotzner, Spalek & Wartenburger, 2013; Gotzner & Spalek, 2016). However, focus particles seem to affect the access of these alternatives in a different way than pure prosodic focus, presumably due to the more complex relationship between the focused element and its alternatives that is induced by the particle's semantics. Finally, the study shows that listeners seem to activate unmentioned alternatives in addition to alternatives mentioned in the context.

The experiments by Kim (2012) illustrated the importance of context for the establishment of focus alternative sets. They therefore empirically verify the claim by Rooth (1985, 1992) and Wagner (2006, 2012), i.e. that the set of alternatives is restricted by context.

Gotzner' s (2015b) novel analysis of the unrelated items used in Gotzner et al. (2016) leads to a different conclusion than my brief analysis of the results by Braun and Tagliapietra (2010), namely that it is likely that a broad set of alternatives is involved in the computation of a focused element, i.e. an alternative set as predicted by Rooth's permissive account (1985, 1992). However, it is important to keep in mind that the analysis by Gotzner (2015b) was a post-hoc analysis that looked at nouns. As Gotzner says herself, in order to "make a strong claim about the restrictive view proposed by Wagner (2006), it would be important to set up an experiment with the specific examples discussed by Wagner, comparing target items that are either mutually exclusive adjectives or not" (2015b, p. 243).

To close this knowledge gap mentioned by Gotzner (2015b), I conducted a study that was specifically designed to adjudicate for or against the two accounts on focus alternative sets. In the following, I will first outline the specific aims of the study and my hypotheses, before moving on to the detailed description of materials, procedure and results.

3. Experimental research on the extent of focus alternative sets

3.1 Aims and hypotheses

Previous experimental studies provide evidence that listeners activate contrastive alternatives upon hearing a focused element and thus claim that alternative sets contain contrastive alternatives. The question that previous research cannot yet answer is whether the alternative set **only** contains these contrastive alternatives or whether non-contrastive alternatives that are grammatically and contextually appropriate replacements are also included.

Therefore, the specific aim of this study is to investigate whether focus alternative sets are restricted to contrastive, mutually exclusive alternatives, as claimed by Wagner's restrictive theory (2006, 2012), or if alternative sets contain a broader set of alternatives that includes contrastive alternatives as well as non-contrastive alternatives that are possible replacements for the focused element, as suggested by Rooth's permissive theory (1985, 1992).

In my experiment, I use a cross-modal-priming paradigm to investigate which elements are activated when processing a focused word, and therefore to gain evidence in favour of either one of the two theories. This experimental paradigm was chosen because previous studies (e.g. Braun & Tagliapietra, 2010; Husband & Ferreira, 2015; Gotzner et al., 2016) showed that it is a suitable experimental design to investigate alternative sets. While previous studies have looked at nouns as focused elements, the current study investigates alternative sets for focused adjectives. This allows me to directly advocate for or against the restrictive theory, as Wagner (2006, 2012) builds this theory on adjectives.

Participants first heard auditory dialogues that each consisted of a question and an answer. The answer contained the discourse-new adjective that served as the focused prime word. Each dialogue was followed by a visually presented target word, which was either a Wagner alternative, a Rooth alternative or an unrelated target. Participants then had to press a button to indicate whether the written target word was an existing German word or not. I measured the time the participants took to identify the critical targets as real German words to then compare the reaction times of all three conditions with each other.

On the basis of the information provided in Chapter 2, I predict the following for the three different groups of targets. First, I predict that the focal pitch accent of the prime word activates Wagner alternatives, which allows participants to recognise this group of targets faster than the unrelated target words. This prediction would not only be supported by the

restrictive but also by the permissive account, as both agree that contrastive alternatives are part of the alternative set. Furthermore, previous experimental studies have provided evidence in support of this prediction, although their research looked at focused nouns. For the Rooth alternatives, there are two possible outcomes. First, if Rooth alternatives are part of the alternative set as assumed by the permissive account, then this group of target words should be activated while processing the focused prime word. This should then enable participants to recognise these target words faster than the unrelated targets. Second, if Rooth alternatives are not part of the alternative set as suggested by the restrictive account, then this group of targets words should not be recognised faster than unrelated target words.

3.2 Material

3.2.1 Critical items

For the experiment, 51 short dialogues were created, each containing a question and a corresponding answer (for a list of the final items, see Appendix B, Table B1). I chose question-answer-scenarios as focus is here commonly used for pragmatic purposes (e.g. Krifka, 2007). Furthermore, in an experimental setting, the question provides an appropriate context for the use of focus in the answer. Each question (see 32a.) started with an interrogative wh-phrase followed by the structure NP1 (object) – Auxiliary – NP2 (subject) – Preposition phrase – Participle. The preposition phrase was inserted to provide more context and thus to narrow down / specify the setting.

(32) **a. Speaker 1 – Question (context sentence):**

Was für ein Buch hat Georg in der Schule gelesen?

What kind of book did Georg read at school?

b. Speaker 2 – Answer (critical sentence):

Er hat ein [spannendes]$_F$ Buch gelesen.

He read a thrilling book.

c. Targets in three conditions:

Wagner alternative: *langweilig (boring)*

Rooth alternative: *historisch (historical)*

Unrelated target: *zufrieden (satisfied)*

The answer was the critical sentence (32b.), containing an adjective that functioned as the critical, focused prime word, corresponding to the wh-phrase in the question. Thus, the question-answer-scenarios were well-formed and congruent (e.g. Paul, 1880; Halliday, 1967; Krifka, 2007; Büring, 2012), satisfying the generalisation in (33), taken from Reich (2002, p. 1).

(33) If *A* is a direct/congruent answer to *Q*, then every constituent in *A* that corresponds to a wh-phrase in *Q* is focused.

Each answer had the same sentence structure, i.e. Pronoun – Auxiliary – Indefinite article – Adjective – Object – Participle, to have a set of items that is as homogeneous as possible. Most prime words might be considered as rather unexpected after hearing the proceeding question, like, for example, screaming at a good child (item N°49), get a dirty sofa delivered (item N° 27), or wear a thin jumper while being on ski holidays (item N° 37). However, I believe that the alternatives to a rather unexpected prime word might become even more salient, as listeners are likely to consider all the other alternatives that might have been more likely to occur.

Each dialogue was paired with a visually presented target word in one of three conditions, on which the lexical decision task was performed. The target word (32c.) was either a Wagner alternative (*boring*), a Rooth alternative (*historical*), or an unrelated target word (*satisfied*). In line with the restrictive view, all Wagner alternatives (WA) were not only contrastive but they and the focused adjective were mutually exclusive (**ein spannendes, langweiliges Buch*), while Rooth alternatives (RA) were possible alternatives that could be substituted for the focused adjective but they did not negate one another (*ein spannendes, historisches Buch*). The unrelated targets (UT) were adjectives (i.e. same semantic type (et)) that were no alternatives for the focused adjectives, as they were not appropriate replacements in the given context (**ein zufriedenes Buch*).

Previous research indicates that the length of a word (e.g. Forster & Chambers, 1973; Pollatsek, Juhasz, Reichle, Machacek & Rayner, 2008) the number of its syllables (e.g. Stenneken, Conrad & Jacobs, 2007) and the frequency with which it occurs in a language (e.g. Oldfield and Wingfield, 1965; Howes and Solomon, 1951; for a discussion see Brysbaert & New, 2009) are factors that influence the time it takes to process a word. To avoid the possibility of these factors influencing the processing time of the target words, the targets of each

condition needed to be as similar as possible with regards to their length, number of syllables and frequency. For the comparison, I extracted the following information for each target from the lexical database *dlexdb* (Heister, Würzner, Bubenzer, Pohl, Hanneforth, Geyken, & Kliegl, 2011): number of letters, number of syllables and the annotated type and lemma frequency (for both the absolute frequency and the normalised frequency).

The first analysis showed that the targets as a group were relatively similar in all three conditions with regards to their number of letters, number of syllables and their type frequency (absolute and normalised). The lemmas of some target words, however, occurred with a much greater absolute frequency (above 25.000) than others (mean lemma frequency absolute: 6962,77). Therefore, some of these targets were substituted by new words, while others had to be removed altogether. Removing these targets resulted in the exclusion of six dialogues, leaving 45 dialogues altogether.

The analysis of the new set of targets (see Table 1 for the descriptive statistics and the ANOVA results)[22], shows that the target words of each condition (RA, WA and UT) do not differ significantly in their number of letters ($F(2,132) = 0.449$, $p= 0.639$), their number of syllables ($F(2,132) = 0.845$, $p= 0.432$), their absolute type frequency ($F(2,132) = 0.125$, $p= 0.882$), their normalised type frequency ($F(2,132) = 0.620$, $p= 0.539$), their absolute lemma frequency ($F(2,132) = 0.483$, $p= 0.618$) or their normalised lemma frequency ($F(2,132) = 1.020$, $p= 0.363$). Thus, one can assume that any processing time differences between the three groups cannot be attributed to these factors.

After matching the targets with regards to the factors explained above, it needed to be ensured that each target was a perfect fit for its condition. I wanted other German native speakers to confirm that 1. the Rooth alternatives and the Wagner alternatives were equally good substitutes for the prime words, i.e. that in all three cases the sentences were considered to be equally meaningful, and 2. that the unrelated targets were not suitable adjectives in the context, i.e. not alternatives that could replace the prime words. Thus, I carried out a pre-study, in which participants were asked to rate the sentences' meaningfulness.

[22] Please note that this is the analysis of the final set of targets that was used for the experiment. It also includes target words that have been added or substituted as a result of the rating study described later on in this chapter.

Table 1

Descriptive statistics and ANOVA results for the number of letters, number of syllables, absolute and normalised type frequency, as well as absolute and normalised lemma frequency for all three target type conditions (Rooth alternatives (RA), Wagner alternative (WA), Unrelated targets(UT)). The descriptive statistics include number of items, mean, standard deviation, minimum and maximum values. For the ANOVA results, the *F*- and p-values are reported.

	Target type	**N**	**Mean**	**SD**	**Min**	**Max**	***F***	**p**
N° letters	RA	45	6.27	1.78	3	10		
	WA	45	6.07	1.86	4	11		
	UT	45	6.42	1.71	4	10		
							0.45	0.64
N° syllables	RA	45	1.73	0.58	1	3		
	WA	45	1.67	0.67	1	3		
	UT	45	1.84	0.71	1	3		
							0.85	0.43
Type freq. abs.	RA	45	1539.0	2429.3	10	13185		
	WA	45	1791.7	2627.5	3	14509		
	UT	45	1662.6	2092.9	6	12133		
							0.13	0.89
Type freq. norm.	RA	45	0.62	0.81	-1.09	2.03		
	WA	45	0.79	0.70	-1.61	2.07		
	UT	45	0.74	0.75	-1.31	2.00		
							0.62	0.54
Lemma freq. abs.	RA	45	4392.5	5187.5	36	21926		
	WA	45	5015.4	5685.4	16	26935		
	UT	45	3949.1	4578.5	18	22807		
							0.48	0.62
Lemma freq. norm.	RA	45	1.12	0.79	-0.53	2.25		
	WA	45	1.33	0.61	-0.88	2.34		
	UT	45	1.23	0.60	-0.83	2.27		
							1.02	0.36

Each sentence was included in four different versions, namely 1. including the prime word (*Er hat ein spannendes Buch gelesen*), 2. including the Rooth alternative (*Er hat ein historisches Buch gelesen)*, 3. including the Wagner alternative (*Er hat ein langweiliges Buch ge-*

lesen), and 4. including the unrelated target *(Er hat ein zufriedenes Buch gelesen)*. The resulting 180 sentences (4x45) were split into four lists, using the Latin square design which ensured that each list contained each sentence in only one condition, and that each list contained about the same number of sentences of each condition (e.g. 11 x Prime, 11 x RA, 11 x WA, 12 x UT).

Participants were recruited using a variety of mailing lists for students (Humboldt-Universität zu Berlin) and via the distribution of the survey link in multiple Facebook groups for Linguistics and Psychology. In total, 119 German native speakers completed the survey. However, I only evaluated the data of the first 25 people for each list. The mean age of the participants was 25 (minimum age: 18, maximum age: 36, sd = 3.83). 72 participants were female and 28 were male.

I used LimeSurvey (LimeSurvey GmbH, 2017) to implement the survey. Sentences were presented one by one, not allowing participants to return to previously rated sentences. The participants were asked to rely on their intuition as German native speakers when rating the sentences' meaningfulness on a scale from 1 to 5, with 1 being "meaningless (sinnlos)" and 5 being "perfectly fine (Vollkommen in Ordnung)". Participants were told that there are no correct or incorrect answers and that their rating was used to choose the most suitable material for a psycholinguistic experiment.

Table 2

Descriptive statistics for the mean rating (meaningfulness) of sentences containing primes, Rooth alternatives, Wagner alternatives or unrelated targets, including number of items, mean rating, standard deviation, standard error, minimum and maximum values.

Condition	N	Mean	SD	Std. Error	Min	Max
Prime word	45	4.60	0.34	0.05	3.68	5.00
Rooth alternatives	45	4.60	0.41	0.06	3.32	5.00
Wagner alternatives	45	4,63	0.36	0.05	3.16	5.00
Unrelated targets	45	1.51	0.52	0.08	1.00	3.28

The results of the rating study (Table 2) indicated that the sentences including the prime (mean: 4.60, sd = 0.34), the Rooth alternative (mean: 4.59, sd = 0.41) and the Wagner alternative (mean: 4.63, sd = 0.36) were all considered to be similarly meaningful, while the sentences including the unrelated target were rated considerably less meaningful (mean: 1.51, sd = 0.52). Although the results confirmed that the targets had been chosen appropriately according to their condition, I wanted to ensure that every target rather than the whole target group was an appropriate candidate for its condition.

To achieve that, I identified all sentences that received a rating lower than 4,0 (for sentences including the prime word, the Rooth or the Wagner alternative) or a rating higher than 1,9 (for sentences including the unrelated target). Every sentence not meeting this threshold was improved with the help of two other German native speakers by either changing the whole sentence context, using a different verb or substituting the adjective. These adjusted sentences were then again rated on LimeSurvey, following the same procedure as in the first rating. The list of items contained three sentences including a prime word, six sentences including a Rooth alternative, one sentence including a Wagner alternative and nine sentences including an unrelated target. The link for the survey was distributed via the mailing list for all students of the Humboldt-Universität zu Berlin and in total, 150 German native speakers completed the survey. Again, I only evaluated the first 25 participants, including 20 women and 5 men, whose mean age was 24 (min: 18, max: 35, sd = 3,94).

After the adjustments, every item reached the threshold previously set for its condition and, as the descriptive statistics in Table 3 illustrate, the sentences of the three groups (prime, RA, WA) reached an even higher mean rating than before (Ø = 4,65, sd = 0,29; Ø = 4,69, sd = 0,22; Ø = 4,67, sd = 0,29 retrospectively). An ANOVA confirmed that the difference between these three groups is not significant ($F(2, 132) = 0.351$, $p = 0.705$). The sentences containing the unrelated target had an overall lower mean rating after the adjustments (Ø = 1.35, sd = 0.27) and post hoc tests confirmed that the differences between the rating of the UT sentences and the rating of each of the three other conditions was significant (Table 4).

Table 3

Descriptive statistics for the meaningfulness rating (including second LimeSurvey rating) of sentences containing primes, Rooth alternatives, Wagner alternatives or unrelated targets, including number of items, mean rating, standard deviation, standard error, minimum and maximum values.

Condition	N	Mean	SD	Std. Error	Min	Max
Prime word	45	4.65	0.44	0.04	4.00	5.00
Rooth alternatives	45	4.69	0.32	0.03	4.20	5.00
Wagner alternatives	45	4,67	0.43	0.04	4.04	5.00
Unrelated targets	45	1.35	0.41	0.04	1.00	1.96

Table 4

Results of the post-hoc test: Tukeys HSD, including mean difference, standard error and p-values.

Contrast	Mean difference	Std. Error	*p*
Unrelated vs. Prime	- 3.295	0.057	0.000
Unrelated vs. Rooth	- 3.342	0.057	0.000
Unrelated vs. Wagner	- 3.316	0.057	0.000

Thus, the results of the first pre-study showed that the Rooth alternatives and the Wagner alternatives were equally suitable substitutes for the prime words in the given context, while the unrelated targets were not.

3.2.2 Filler items

In order to distract participants from the purpose of the study, I created 85 filler items that were later added to the critical items in each list. Thus, the ratio of critical items to filler items was about 1/3 to 2/3.

The filler items can be divided into three different groups, namely those with a narrow focus on the adjective (adj-foc), those with a narrow focus on the subject (sub-foc) and those where the whole verb phrase is focused (wide-foc). The structure of the adj-foc fillers is the same as that of the critical items, but the filler items were paired with a target that was not a

real German word, i.e. a pseudoword. 15 of these items were included (see 34a.), so that not all sentences with a focused adjective were paired with a target word that is a real word of German. As 25 % of the sentences with a focused adjective were now followed by a pseudoword, participants would not be able to predict the answer for the lexical decision task. Furthermore, 35 fillers each of the type sub-foc (34b.) and wide-foc (34c.) were included to 1. distract participants from the importance of adjectives in the experiment, and 2. to provide some variability in the structure and prosody of the items, to avoid participants losing interest and concentration due to a too monotone structure of the sentences. 25 sub-foc fillers and 25 wide-foc fillers were paired with pseudowords, while the remaining 10 fillers of each group were paired with a real word. Thus, altogether the ratio of words to non-word in the experiment was balanced (65 each), not allowing participants to develop a bias for one of the two answer conditions.

(34) a. Q: *Was für ein Reinungsmittel hat Henriette im Bad verwendet?*
What kind of detergent did Heriette use in the bathroom?
A: *Sie hat ein [chemisches]$_F$ Reinigungsmittel verwendet.*
She used a chemical detergent.
Target word: *fleiker*

b. Q: *Wer ist auf einen morschen Baum im Hinterhof geklettert?*
Who climbed on a rotten tree in the backyard?
A: [Maja]$_F$ *ist auf einen morschen Baum geklettert.*
Maja climbed on a rotten tree.
Target word: *Iris*

c. Q: *Was hat Emil gemacht?*
What did Emil do?
A: *Er [hat einen schlafenden Löwen im Zoo fotografiert]*$_F$.
He photographed a sleeping lion in the zoo.
Target word: *gähment*

3.2.3 Recording and prosody

The 130 question-answer-pairs were recorded three times each to have several recordings to choose from. The recording took place in a sound-treated booth using two directional Sennheiser (ME64) microphones, an Edirol E09 solid state recorder (44.1 kHz sampling frequency, 16bit resolution), and a 13-inch laptop, used to display the dialogues orthographically. Question and answers were read by two German native speakers with a northern German accent, close to the standard variety of German. The questions were read by myself and the answers were read by another female speaker, who has had previous phonetic training. A phonetician overlooked the recording procedure to ensure best possible quality as well as consistent intonation across all focus conditions. The reading list was constructed in such a way that all items with adjective focus were read first, then the subject focus items and then the ones containing the wide focus. This ensured direct comparison between items of one condition. The answers were read in response to the questions in order to provide appropriate context and to ensure that the intonation of the answers was as natural as possible.

The questions were read with a special *echo question contour* (Artstein, 2002), containing a rising pitch accent (here, on the wh-constituent) and a high rising boundary. Figure 2 shows the question contour exemplary for one of the items. According to Artstein (2002), this intonation pattern either expresses that the speaker genuinely questions part of the interlocutor's utterance because the speaker did not understand it properly, or that the speaker objects to that part of the utterance. I chose this special question contour to license the content of the questions used in the experiment (see Chapter 3.2.1 for reasons for this structure). The questions for the adjective and the subject focus conditions both included a subject, object, verb and a prepositional phrase, meaning that this information is already part of the common ground of the speaker and his interlocutor, i.e. the information must have been shared (either explicitly or implicitly) in a previous utterance by the interlocutor. Therefore, the only appropriate reason for the speaker to repeat the information again is because he wants to highlight that he understood everything apart from that part of the utterance that he is now asking for (i.e. the adjective).

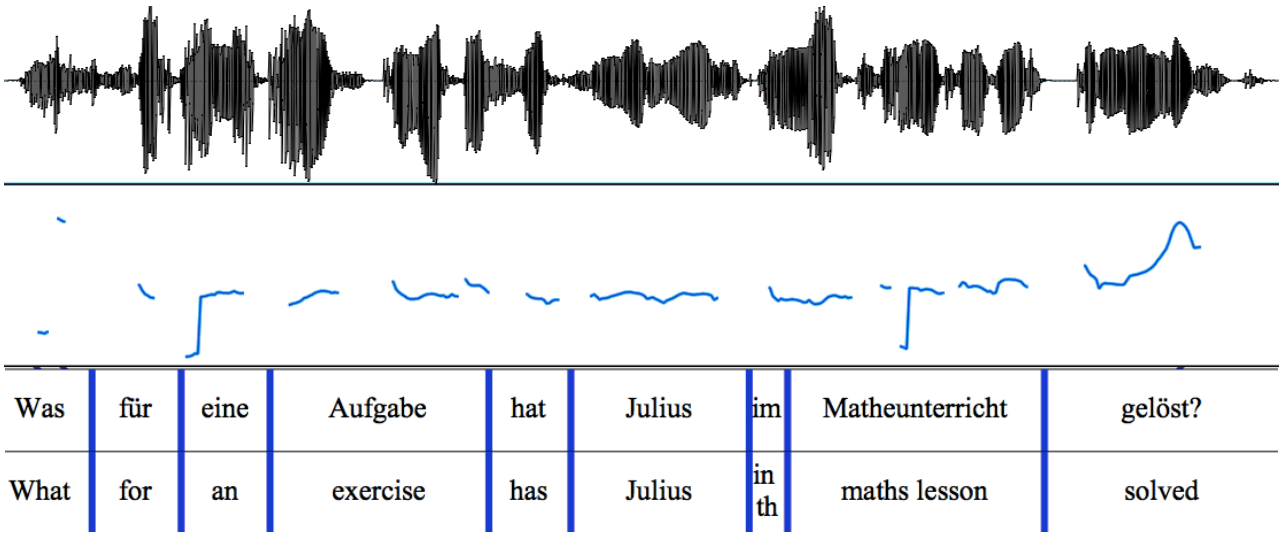

Figure 2: Exemplary illustration of the pitch contour of the questions.

Although, as mentioned above, Artstein assigns two functions to this question contour, saying that "they are pretty much interchangeable [because] they are pragmatically appropriate in the same contexts" (2002, p. 99), I am certain that participants in my experiment will interpret the intonation contour as genuine asking for a repetition of the utterance because only this function requires an actual answer. In the second function, i.e. objecting to the part of the interlocutor's utterance, the question should be perceived as a rhetorical question, making the answer that is given in my experiment infelicitous and inappropriate[23].

The answers in the adjective focus condition (critical items and 15 filler items) were read with a high pitch on the adjective[24], as illustrated in a representative example in Figure 3. In the subject focus condition, the subject bore a pitch accent and in the wide focus condition the whole verb phrase was focused (see Appendix B, Figure B3 and B4).

[23] But even if participants were to interpret the question contour differently, I believe it might make alternatives even more salient, as participants would take unlikely as well as likely candidates into consideration.

[24] I will refrain from describing the pitch accent by using the Tones and Break Indices (ToBi) (e.g. Silverman et al., 1992), as these can be subject to subjective reading (e.g. Breen et al., 2010).

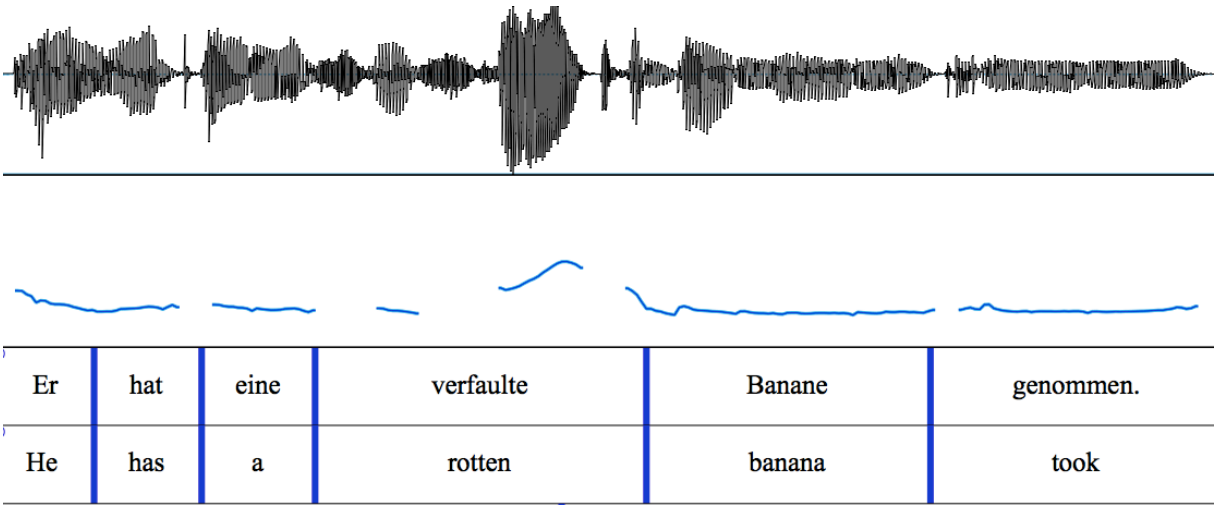

Figure 3: Exemplary illustration of the pitch contour in answers with a narrow focus on the adjective.

Once the best version of each question-answer-pair was chosen, it needed to be verified that the intended prosodic structure was indeed identifiable by other naive native speakers of German. While one could have used an audio analysing program like Praat (Boersma & Weenink, 2017) to statistically verify that the intended focus was realised in the correct location, as mentioned in Chapter 2.1.3, some previous studies (e.g. Breen et al., 2010; Alter et al., 2001) have shown that listeners are not always able to identify acoustic properties, even when they have previously been statistically verified. Thus, a survey was conducted instead, in which native speakers of German had to identify the most prominently pronounced word or phrase in the sentence.

160 native speakers of German participated in the survey, 40 people per list. The mean age of the participants was 24, with a minimum age of 18 and a maximum age of 33 (sd=3,86). 109 participants were female and 51 participants were male, i.e. 68,1% and 31,9%, retrospectively.

The 130 recorded answers of all items were split into 4 lists, ensuring that each list contained roughly the same number of items of each focus category (adjective focus, subject focus, wide-focus).

Again, the survey was implemented in LimeSurvey (LimeSurvey GmbH, 2017). The answer sentence of each item[25] was presented as an audio file that listeners could play as often

[25] The corresponding question was not presented, as it would have directly pointed towards the focused constituent.

as they liked. The task was to identify the most prominently pronounced word/word group. For each sentence, I provided a customised list of words / word groups in a drop-down menu from which the participants had to choose[26]. At the end, participants were asked to state their gender and their age and to confirm that they are native speakers of German.

The results of this second pre-study are visually presented in Figure 4. For the group of sentences with an intended narrow focus on the adjective, on average, 99,2 % of the time, participants indicated that the adjective was the most prominently pronounced word in the sentence (sd=1,94; min=90%, max=100%)[27]. For the group of sentences with an intended narrow focus on the subject, participants rated in 99,1% the subject to be the most prominent constituent of the sentences (sd=1,61; min=98,7%, max=99,5%). For the sentences where a wide focus was intended, participants' ratings varied. In 36,4% of the time, participants chose the prepositional phrase as the most prominently pronounced constituent (sd=31,1, min= 0%, max=95,0%), and in 55,7% of the time, they rated all constituents to be pronounced the same (sd=29,5, min = 2%, max=97,5%). The remaining 7,9% were split equally across the other options. The greater variety in the wide focus condition was expected. Many participants identified the preposition phrase as the most prominent word group. This was expected as it is the rightmost constituent in the sentence before the verb and thus is likely to carry the sentence's nuclear accent (e.g. Chomsky & Halle, 1968; Büring, 2001; Truckenbrodt, 2012) However, it is not surprising that many participants thought that all constituents are similarly prominent, as the nuclear accent can be very subtle and thus hard to identify. However, what is important is the fact that participants mostly did not identify the adjective or the subject as the most prominent word, which clearly distinguished the three focus conditions from one another.

Thus, the results of the survey indicate that the sentences of each condition do in fact carry the prosodic structure that was intended.

[26] For the sentences of the two narrow focus conditions, participants could choose from a list that included: subject, adjective, object, verb, all words are the same.
For the sentences of the wide focus condition, the list included: subject, adjective, object, preposition phrase, verb, all words are the same.

[27] The information in the brackets (min=90%, max=100%) need to be interpreted as follows: For at least one item of the adj-foc condition, 'only' 90% of the participants chose the adjective to be the most prominently pronounced word (minimum), while for at least one item of the same group, 100% of the participants chose the adjective (maximum).

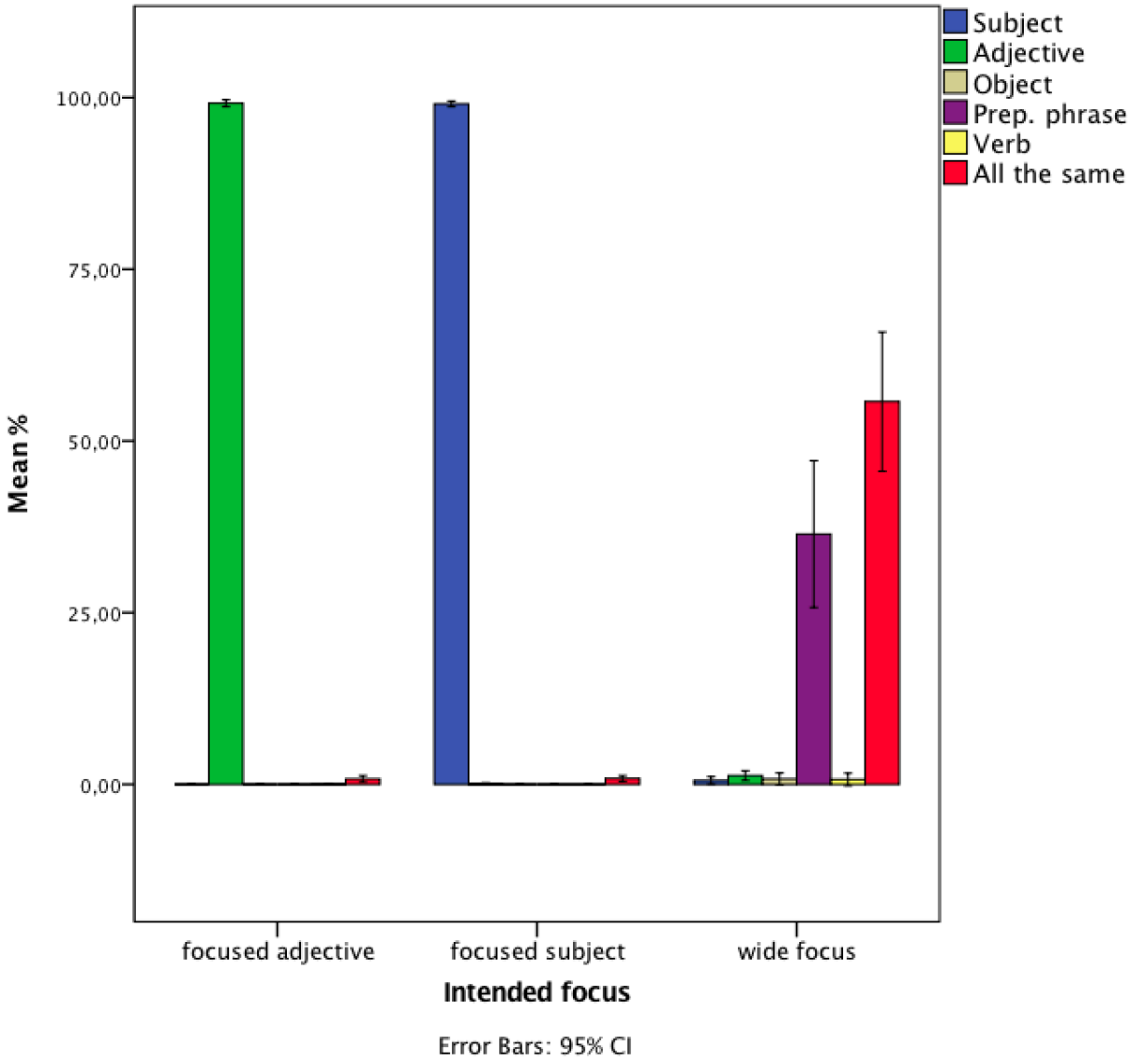

Figure 4: Results of pre-study 2. The x-axis shows the three focus groups, containing an intended narrow focus on the adjective, an intended narrow focus on the subject or an intended wide focus (whole VP). The y-axis shows the average percentage a certain word / word group was chosen by the participants to be the most prominently pronounced.

3.2.4 Comprehension questions

For a comprehension task, I created 30 comprehension questions about the content of some of the auditory stimuli (23% of the items), that would be asked at random intervals throughout the experiment. Three examples are illustrated in (35). This task was included in the procedure to ensure that participants have an incentive to listen attentively to the dialogues containing the prime word, as performing the lexical decision task itself did not require them to do so.

The questions were designed to check participants' knowledge of the name, the adjective, the noun or the prepositional phrase, so that participants knew that they had to carefully listen to all the information mentioned in the dialogues. The results of this comprehension task were later used to verify that participants paid attention to the dialogues (for more details, see Chapter 3.5: Results).

(35) a. *Hat Romy sich ein bedrucktes Kleid im Katalog bestellt?* (question for item 7)
Did Romy order a printed dress in the catalogue?
b. *Hat Leonie mit einer Freundin auf dem Festival gefeiert?* (question for item 66)
Did Leonie party with a friend at a festival?
c. *Hat Jonas sich über eine Kontrolleurin im Bus aufgeregt?* (question for item 103)
Did Jonas get angry because of a ticket inspector in the bus?

3.2.5 Experimental lists

Three lists (List A, B, C) were created, using the Latin square design. Each list contained 45 critical items, i.e. 15 items of each condition (15 target words = Rooth alternatives, 15 target words = Wagner alternative, 15 target words = unrelated targets), ensuring that each list contained every sentence in only one condition. The 85 filler items were added to every list. Each list (A, B and C) was pseudo-randomised twice[28] using the programme Mix (van Casteren & Davis, 2006), ending up with 6 experimental lists in total (List A1, A2, B1, B2, C1, C2). Creating two versions of each list was to ensure that the order in which the items were presented, would not have an influence on the results. Participants were randomly assigned to a list.

3.3 Participants

32 participants took part in the experiment and were given monetary compensation for their participation. One participant was excluded from further analysis due to her multilingual back-

[28] The following criteria was used for the pseudo-randomisation:
- no more than 2 critical items in a row
- no more than 5 filler items in a row
- no more than 3 of the same responses (word/non-word) in a row
- no more than 3 items with the same focus condition in a row
- a minimal distance of 5 for items whose target word belonged to the same semantic category (e.g. colours, sizes, weight etc.)

ground, which was discovered after the data collection was completed. The remaining 31 participants were German native speakers (no other language before the age of five) and students. The participants' mean age was 26,6, with a minimum age of 19 and a maximum age of 31 (sd = 3,57). 21 participants were women, 10 were men. 28 participants were right-handed, the remaining three were left handed[29], and no one reported any visual or hearing impairments. None of the participants took part in either of the two pre-studies described in Chapters 3.2.1 and 3.2.3.

3.4 Procedure

Participants were seated in an experimental room in front of a 17-inch Belinea LCP-screen, wearing a PC131 Sennheiser headset. The experiment started with written instructions on the screen about the structure of the experiment, including an explanation of the tasks the participants would have to perform. Participants were informed about the structure of the auditory stimuli (question and answer) and that their task was to decide whether the written word that appeared after the dialogue was a real word of German or not. They were asked to listen attentively to the dialogues and to respond as fast and as accurate as possible when deciding about the displayed word. Participants were also informed that detailed questions about the dialogues would be asked at random intervals throughout the experiment and that they can take their time to think before answering these questions.

After reading the instructions, participants performed six practice trials, during which they could adjust the sound volume. Figure 5 illustrates the basic structure of a trial. Each trial began with a fixation cross displayed for 500 ms on the screen to inform participants about the start of a new trial. Afterwards, an audio sign appeared on the screen, while the auditory stimuli were presented over the headphones. With an offset of 100 ms the target word appeared on the screen and participants had to decide whether the written word was an existing word of German or not by pressing a button. The target word remained on the screen until a decision was made. If there was not response within 5000 ms, the trial would be counted as a miss and either the next trial would be initiated or the comprehension question would appear on the screen. If there was a comprehension question, participants would have to answer

[29] Although one could assume that a participant's strong hand might elicit faster reaction times in lexical decision tasks than the weak hand , this does not affect the data of the present lexical decision task, as all three critical conditions had to be responded to with the same hand (see Chapter 3.4: Procedure).

the question by pressing a button and the question would stay on the screen until a response was given. Then the next trial would be initiated with an offset of 1000 ms during which a blanc screen was presented. This allowed participants some time to prepare themselves for the next trial.

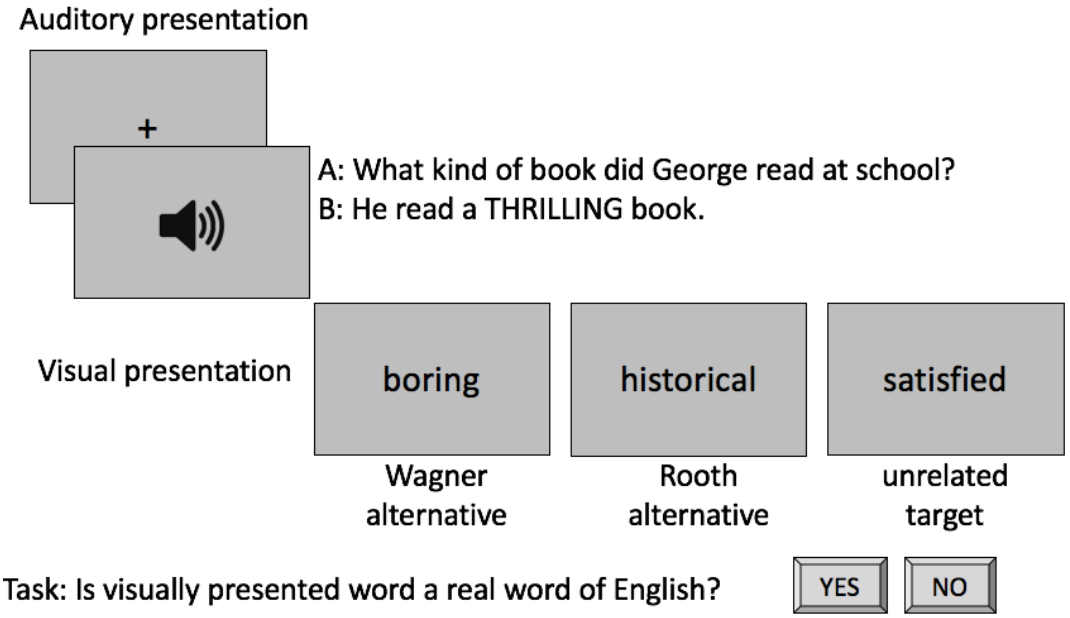

Figure 5: Basic illustration of a trial.

In total, there were five blocks of 26 trials, giving participants the chance to take a short break in between each block. The experiment lasted approximately 25 minutes. Afterwards, participants were asked a set of questions, containing questions about their age, their gender, their mother tongue, their handedness, their subject of study and a question about the purpose of this study. All participants were tested individually.

3.5 Results

The data analysis was done with Version 1.0.136 of R Studio (RStudio Team, 2015). After analysing the distribution of false answers in the comprehension task, three participants were excluded from further analysis, as their error rate (more than seven false answers) was not

within normal distribution[30]. As the number of mistakes can be an indicator that participants were not attentively listening to the auditory stimuli containing the prime, their reaction time data could not be part of the analysis.

For the remaining 28 participants, the overall accuracy in the lexical decision task was 99.12% for the critical items. All inaccurate trials (11 in total) were excluded, resulting in a loss of 0.88% of the data.

The statistical analysis was performed using a Linear mixed effect model (LMEM), which was run using the function lmer of the R package lme4 (Bates, Mächler, Bolker & Walker, 2015). The advantage of a LMEMs in comparison to for example ANOVAs is that one can include various random effects into the analysis in addition to the controlled fixed effect(s). Random effects can be aspects such as participants' individual (performance) differences or individual item difference, whose influence on the dependent variable is unknown but possible (e.g. Baayen, 2008).

The final model used for the analysis included the reciprocal transformation of reaction times, second order polynomial of the trial number[31] and the target type as fixed effects, and the second order polynomial of the trial number for each participant and item as random effects. I used individual coding for the factor target type: the first contrast, named alternatives_vs_unrelated targets, compared both alternative target conditions to the unrelated target condition (Rooth alternatives and Wagner alternatives vs. unrelated targets), while the second, named Wagner vs. Rooth, compared the Rooth alternative condition to the Wagner alternative condition. The resulting p-values were calculated using the lmertest package (Kuznetsova, Brockhoff, & Christensen, 2015).

The linear mixed model that was used requires normally distributed residuals. A look

[30] The threshold of seven mistakes, which was set on the basis of the normal distribution of all participants, also roughly coincides with the threshold of 25% of incorrect answers, which is often used to exclude participants from further analysis (e.g. Husband & Ferreira, 2015; Byram Washburn, 2013). However, I decided to use an individual threshold based on the actual data rather than a fixed percentage, as the difficulty of the task might vary between experiments.

[31] The trial numbers (1-130) refer to the order in which the items were presented. The polynomial second order of the trial number was included, as the visual analysis of the reaction time for each trial and each participant indicated that participants' speed increased over time. Including the order with which items occurred (i.e. trial) into the analysis, incorporates this effect into the calculation.

at the residual distribution showed five data points, whose residuals were not within the normal distribution. These five outliers were excluded from further analysis. This method of identifying outliers was used due to a relatively limited number of trials in each condition for each participant (15 trials). Other researchers (e.g. Braun & Tagliapietra, 2010; Byram Washburn, 2013; Gotzner, 2015a) often use the standard deviation of each participant to set the threshold for outliers. This method, however, requires a great number of trials in each condition to result in the calculation of a reliable standard deviation. The mean reaction times for each condition based on the model explained above are visualised in Figure 6 and the corresponding descriptive statistics are summarised in Table 5.

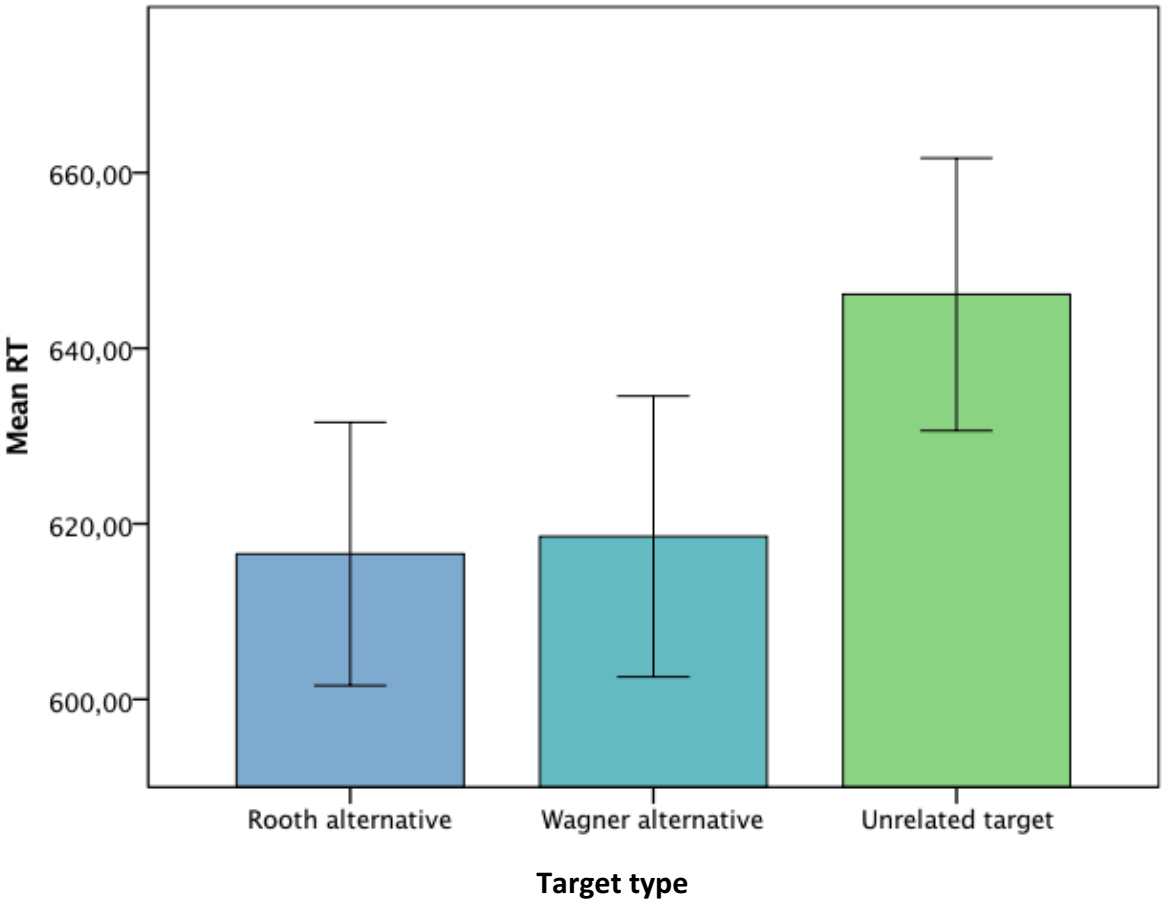

Figure 6: Mean reaction time in ms for the three target types (Rooth alternative, Wagner alternative, Unrelated target) based on the overall model explained above. Error bars represent standard error.

Table 5

Descriptive statistics for the mean reaction time of all three conditions (Rooth alternatives, Wagner alternatives and Unrelated targets), including number of items, mean, standard deviation, standard error, reaction time minimum and maximum.

Condition	N	Mean	SD	Std. Error	Min	Max
Rooth alternatives	415	616.56	152.72	7.50	359.00	1275.00
Wagner alternatives	417	618.55	163.48	8.01	367.00	1264.00
Unrelated targets	412	646.14	157.50	7.76	361.00	1314.00

The mean reaction time for Rooth alternatives was 616.56 ms (sd = 152.72) and 618.55 ms (sd = 163.48) for Wagner alternatives, while the mean reaction time for the unrelated targets was longer, namely 646.14 ms (sd = 157.50).

The results of the linear mixed model, summarised in Table 6, show that the reaction time difference between the two alternative conditions and the unrelated target condition (Alternatives_vs_unrelated) was significant (t = - 4.62, p = <0.0001), meaning that reaction times for both alternative types (Rooth and Wagner alternatives) together were significantly faster than the reaction time for the unrelated targets. However, the reaction time difference between the two alternative conditions (Wagner vs. Rooth) was not significant (t = 0.42, p = 0.675). A post-hoc test was conducted to get a more detailed insight into the differences between the three conditions. As the summary in Table 7 shows, the reaction time for Rooth alternatives was significantly faster than the reaction time for the unrelated targets (z = 4.194, p < 0.0001), and the reaction time for Wagner alternatives was also significantly faster than for unrelated targets (z = 3.804, p = 0.0003).

Table 6

Results of linear mixed model for reaction time, including estimates, standard error, t values and p values.

Model: -1/RT ~ poly(trial,2) + target type + (1+poly(trial,2|VP)+(1|item)

	Estimate	**Std. Error**	**T value**	**Pr(>|t|)**
Intercept	-1.687e-03	4.481e-05	- 37.64	< 0.0001
Poly(trial, 2) 1	-2.766e-03	5.839e-04	- 4.74	< 0.0001
Poly(trial, 2) 2	7.061e-04	4.369e-04	1.61	0.117
Alternatives_vs_unrelated	-2.537e-05	5.491e-06	- 4.62	< 0.0001
Wagner_vs_Rooth	4.001e-06	9.526e-06	0.42	0.675

Table 7

Results of the post-hoc test: Tukeys Contrast, including estimates, standard error, z-values and p-values.

Contrast	**Estimate**	**Std. Error**	**z- value**	**Pr(>|z|)**
Wagner vs. Unrelated	7.211e-05	1.896e-05	3.804	0.0003
Rooth vs. Unrelated	8.011e-05	1.910e-05	4.194	< 0.0001

3.6 Discussion

The data presented above shows that there is a significant difference between the two alternative conditions and the unrelated target condition. Participants recognised words that could substitute the prime word significantly faster than words that were no possible substitutes. More importantly, however, the post-hoc tests show that there was a significant difference in reaction time between each of the alternative conditions, Rooth alternatives and Wagner alternatives, compared to the unrelated targets. The contrastive Wagner alternatives were recognised faster than unrelated target word, thus confirming my first prediction (Chapter 3.1). Contrastive and mutually exclusive alternatives are activated when processing a focused element and are thus part of the focus alternative set. This result is in line with both theoretical accounts on the extent of alternative sets, i.e. Rooth's permissive theory (1985, 1992) and

Wagner's restrictive theory (2006, 2012), as both would have predicted this group of alternatives to be part of the true set of alternatives. However, as Rooth alternatives were also recognised faster than unrelated targets, it seems as if this group, too, was activated when processing the focused element, confirming my first prediction about Rooth alternatives (Chapter 3.1). Interestingly, no difference was found between the Wagner alternatives and Rooth alternatives. The results therefore indicate that the members of both groups were equally considered as alternatives and that thus both type of alternatives, contrastive and non-contrastive ones, are part of the focus alternative set. Thus, the results support the permissive account, while the claims of the restrictive theory cannot be confirmed.

4. General discussion and conclusion

The primary function of focus is to indicate the existence of alternatives for a focused element. The aim of the current study was to investigate which specific elements belong to this set of alternatives that is activated when processing a focused element. More specifically, I wanted to gain empirical evidence that helps to adjudicate between two theories that make different claims about the extent of alternatives set, and thus come closer at identifying the members of focus alternative sets.

I conducted a cross-modal priming paradigm experiment, where participants were exposed to auditory discourses that contained a focused adjective. Based on previous psycholinguistic research (e.g. Braun & Tagliapietra, 2010; Husband & Ferreira, 2015; Gotzner, 2015a, 2015b; Gotzner et al., 2016; Kim, 2012; Kim et al., 2015), I expected that alternatives for the focused elements would be activated when processing the sentence. This activation would then allow participants to recognise the alternatives faster in a subsequent lexical decision task than words that were not previously activated. In order to adjudicate for or against the two theories on the extent of alternative sets, the reaction times of three groups of target words were measured. The first group were contrastive alternatives that satisfied the requirement of mutual exclusion in accordance with the restrictive account by Wagner (2006, 2012). The second group were non-contrastive alternatives that were grammatically and contextually appropriate replacements for the focused element, i.e. alternatives according to the permissive account by Rooth (1985, 1992). The third group functioned as the base line, containing unrelated targets that could not substitute the focused element in the given context and were thus no alternatives according to the restrictive or the permissive theory.

The results show that both types of alternatives, contrastive and non-contrastive ones, were activated upon hearing the focused adjectives, and thus provide evidence that alternative sets contain elements that can substitute the focused element in the given context. While Rooth's permissive theory would have predicted that both types of alternatives are part of the alternative set, Wagner's restrictive theory would have not. According to Wagner (2006, 2012), Rooth alternatives should not have been facilitated upon hearing a focused element, as they are not contrastive and do not satisfy the requirement of mutual exclusion. Thus, the results support Rooth's permissive theory (1985, 1992), i.e. that alternative sets contain a broad set of grammatically and contextually appropriate replacements for the focused element. The findings are also in line with the post-hoc analysis conducted by Gotzner (2015b). She, too, concluded that "listeners consider[] a broader set of alternatives rather than a limited one" (Gotzner, 2015b, p. 242).

However, the study by Husband and Ferreira (2015) suggests that it might take time for the final set of alternative to be established. Thus, as there was 0 ms between the offset of the auditory stimuli and the onset of the visual target word in my experiment, one might argue that my results might only be an indication that contrastive and non-contrastive elements are being considered as alternatives, but that they do not necessarily prove that both are included in the final set of alternatives. However, based on the structure of my items, I believe this to be unlikely. Firstly, participants were able to make predictions about the upcoming focused element and thus its alternative set on the basis of the preceding question. The eye-tracking studies by Kim (2012) indicate that predictions lead to the activation of possible alternatives, i.e possible alternative are being pre-activated before the focused element is actually encountered. Secondly, the critical items were constructed in such a way that the focused adjective was always followed by the corresponding noun and a participle, resulting in additional time between the focused prime word and the visual target word. Both aspects taken together, should provide listeners with sufficient time to establish the final set of focus alternatives. After all, in real life conversations, listeners would have to establish an alternative set while the discourse continues, which requires this process to be rapidly. Nevertheless, a follow up study with an altered SOA (e.g. 750 ms, as used by Husband and Ferreira (2015)) would be necessary to confirm my claims.

The results of this study provide additional evidence that context is an important factor for the establishment of alternative set, as claimed by the permissive and the restrictive theory. The studies by Byram Washburn (2013) and Kim (2012) already suggest that listeners use contextual information to create sets of alternatives. This study supports those findings. The results show that alternatives are not necessarily of the same semantic network as the focused element. While Wagner alternatives were semantically closely related with the focused adjectives (opposite pairs, e.g. *exciting* – *boring*), Rooth alternatives were not (e.g. *exciting* – *historical*). The relationship between Rooth alternatives and the focused element was only established through context, showing that the restriction of alternative sets is greatly influenced by context.

Interestingly, this aspect is also linked to a possible caveat one might have regarding the interpretation of the results on the basis of the study's design. As the critical experimental items of my study only included one focus condition (i.e. pitch accent on the adjective) and no condition without focus, one might argue that the observed facilitation of the targets could be due to general semantic priming rather than be the result of focus. While this is a valid point, I believe that the results show that this is not the case. If the observed effect (faster recognition) was indeed because of general semantic priming, then one would expect the effect to be much greater for Wagner alternatives than for Rooth alternatives, as Wagner alternatives and the focused elements were opposite pairs and thus semantically much closer related than the Rooth alternatives and the focused elements. As no difference between the two was found, semantic priming cannot have been the (sole) source for the facilitation effect. However, it would be desirable to modify the experimental design in such a way that a no focus baseline is included, so that any doubts can be eliminated. Unfortunately, this would mean that the structure of the items would have to be changed drastically, as question-answer-scenarios require the element in the answer that corresponds to the wh-phrase of the question to be focused.

Although the main aim of the study was to shed light on the extent of alternative sets, the results can also be interpreted with regard to the discussion of whether information focus, like contrastive focus, actually depends on the existence of alternatives. While previous studies based their interpretation on experiments with contrastive focus, this study used information focus. As the results suggest that alternatives were indeed activated when processing

the sentence containing the focused element, one can infer that information focus, like contrastive focus, elicits alternatives, and that the alternative semantics theory can thus be applied to both types. Therefore, the study provides some evidence in support of the unified view of focus, i.e. that contrastive focus and information focus are both (sub)types of the same information structural category.

However, one question that this study is unable to answer is whether or not the alternative sets for the two types of focus differ. There is the possibility that the final set of alternatives could differ for contrastive focus and information focus. For example, the final set of alternatives for contrastive focus might not include Rooth alternatives, as they are not contrastive and therefore of less relevance. Thus, the interpretation of my results with regards to the permissive and restrictive account need to be limited to information focus only. In order to make a claim about focus in general, one would have to conduct a similar study that includes contrastive focus and compare the results.

References

Almor, A. (1999). Noun-Phrase Anaphora and Focus: The Informational Load Hypothesis. *Psychological Review, 106 (4)*, 748-765.

Almor, A., & Eimas, P. (2008). Focus and noun phrase anaphors in spoken language comprehension. *Language and Cognitive Processes, 23*, 201-225.

Alter, K., Mleinek, I., Rohe, T., Steube, A., & Umbach, C. (2001). Kontrastprosodie in Sprachproduktion und -perzeption. *Linguistische Arbeitsberichte, 77,* 59-79.

Artstein, R. (2002). A focus semantics for echo questions. In Á. Bende-Farkas & A. Riester (Eds.), *Workshop on Information Structure in Context* (pp. 98–107). Stuttgart: IMS/University of Stuttgart.

Baayen, H. (2008). *Analyzing Linguistic Data: A Practical Introduction to Statistics using R*. Cambridge: Cambridge University Press.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software, 67* (1), 1-48.

Birch, S., & Rayner, K. (1995). Linguistic focus affects eye movements during reading. *Memory & Cognition, 25*, 653-660.

Birch, S., & Rayner, K. (2010). Effects of syntactic prominence on eye movements during reading. *Memory & Cognition, 38 (6)*, 740-552.

Boersma, P., & Weenink, D. (2017). *Praat: doing phonetics by computer* [Computer program]. Version 6.0.29, retrieved 15 February 2017 from http://www.praat.org/.

Bolinger, D. (1961). Contrastive accent and contrastive stress. *Language, 37,* 83–96.

Braun, B., & Tagliapietra, L. (2010). The role of contrastive intonation contours in the retrieval of contextual alternatives. *Language and Cognitive Processes, 25*, 1024-1043.

Breen, M., Fedorenko, E., Wagner, M., & Gibson, E. (2010). Acoustic correlates in information structure. *Language and Cognitive Processes*, *25*, 1044-1098.

Brysbaert, M., & New, B. (2009). Moving beyond Kučera and Francis: A critical evaluation of current word frequency norms and the introduction of a new and improved word frequency measure for American. *English Behavior Research Methods, 41 (4)*, 977-990.

Büring, D. (2001). Let's phrase it! – Focus, word order, and prosodic phrasing in German double object constructions. In G. Müller & W. Sternefeld (Eds.), *Competition in Syntax* (= Studies in Generative Grammar 49) (pp. 69-105). Berlin / New York: De Gruyter Mouton.

Büring, D. (2003). On D-trees, beans, and B-accents. *Linguistics and Philosophy, 26*, 511–545.

Büring, D. (2007). Semantics, intonation and information structure. In G. Ramchand & C. Reiss (Eds.), *The Oxford Handbook of Linguistic Interfaces* (pp. 445– 474). Oxford: Oxford University Press.

Büring, D. (2010). Towards a typology of focus realization. In M. Zimmermann & C. Féry (Eds.), *Information Structure. Theoretical, Typological, and Experimental Perspectives* (pp. 177–205). Oxford: Oxford University Press.

Büring, D. (2012). Focus and Intonation. In G. Russell & D. G. Fara (Eds.), *The Routledge Companion in the Philosophy of Language* (pp. 103-115). London: Routledge.

Byram Washburn, M. (2013). *Narrowing the focus: Experimental studies on exhaustivity and contrast* (Doctoral dissertation). University of Southern California, Los Angeles.

Carlson, K., Walsh Dickey, M., Frazier, L., & Clifton Jr., C. (2009). Information structure expectations in sentence comprehension. *The Quarterly Journal of Experimental Psychology (Hove), 62 (1)*, 114 – 139.

Chafe, W. (1976). Givenness, contrastiveness, definiteness, subjects, topics, and point of view in subject and topic. In C.N. Li (Ed.), *Subject and Topics* (pp. 25-55). New York: Academic Press.

Chomsky, N. (1970). Deep structure, surface structure and semantic interpretation. In R. Jakobson & S. Kawamoto (Eds.), *Studies in General and Oriental Linguistics*. Tokyo: T.E.C. Corporation.

Chomsky, N., & Halle, M. (1968). *The Sound Pattern of English.* New York: Harper and Row.

Cowles, H.W. (2012). The psychology of information structure. In M. Krifka & R. Musan (Eds.), *The Expression of Information Structure* (pp. 287-318). Berlin: De Gruyter Mouton.

Cutler, A., & Fodor, J. (1979). Semantic focus and sentence comprehension. *Cognition, 7,* 49-59.

É. Kiss, K. (1998). Identificational focus versus information focus. *Language, 74*, 245–273.

Féry, C., & Ishihara, S. (2016). Introduction. In C. Féry & S. Ishihara (Eds.), *The Oxford Handbook of Information Structure* (pp. 1-18). Oxford: Oxford University Press.

Forster, K.I., & Chambers, S.M. (1973). Lexical Access and naming Time. *Journal of Verbal Learning and Verbal Behaviour, 12*, 627-635.

Fraundorf, S., Watson, D., & Benjamin, A. (2010). Recognition memory reveals just how contrastive contrastive accenting really is. *Journal of Memory & Language, 63*, 367-386.

Gotzner, N. (2015a). *Establishing alternative sets* (Doctoral dissertation). Humboldt- Universität zu Berlin, Berlin.

Gotzner, N. (2015b). What's included in the set of alternatives? Psycholinguistic evidence for a permissive view. In E. Csipak & H. Zeijlstra, (Eds.), P*roceedings of Sinn und Bedeutung, 19* (pp. 232-247). Göttingen: Georg-August-Universität Göttingen.

Gotzner, N., & Spalek, K. (2016). The role of contrastive and non-contrastive alternatives in the interpretation of focus particles. *Discourse Processes*. DOI: 10.1080/0163853X.2016.1148981.

Gotzner, N., Spalek, K., & Wartenburger, I. (2013). How pitch accents and focus particles affect the recognition of contextual alternatives. In M. Knau, M. Pauen, N. Sebanz & I. Wachsmuth (Eds.), *Proceedings of the 35 the Annual Meeting of the Cognitive Science Society* (pp. 2434-2440) Austin, TX: Cognitive Science Society.

Gotzner, N., Wartenburger, I., & Spalek, K. (2016). The impact of focus particles on the recognition and rejection of contrastive alternatives. *Language and Cognition, 8*, 59-95.

Grice, M., & Baumann, S. (2002). Deutsche intonation und gtobi. *Linguistische Berichte, 191*, 267-298.

Gussenhoven, C. (2004). *The phonology of tone and intonation*. Cambridge: Cambridge University Press.

Halliday, M. A. K. (1967). *Intonation and Grammar in British English*. The Hague: Mouton.

Hamblin, C. L. (1973). Questions in Montague English. *Foundations of Language, 10*, 41–53.

Heister, J., Würzner, K.-M., Bubenzer, J., Pohl, E., Hanneforth, T., Geyken, A., & Kliegl, R. (2011). dlexDB - eine lexikalische Datenbank für die psychologische und linguistische Forschung. *Psychologische Rundschau*, *62 (1),* 10-20.

Howes, D. H., & Solomon, R. L. (1951). Visual duration threshold as a function of word probability. *Journal of Experimental Psychology, 41*, 401-410.

Husband, E. M., & Ferreira, F. (2015). The role of selection in generating focus alternatives. *Language, Cognition and Neuroscience*. DOI:10.1080/23273798.2015.1083113.

Ito, K., & Speer, S.R. (2008). Anticipatory effects of intonation: Eye movements during instructed visual search. *Journal of Memory & Language, 58*, 541-573.

Jackendoff, R. (1972). *Semantics in Generative Grammar*. Cambridge, Mass: MIT Press.

Jacobs, J. (1983). *Fokus und Skalen*. Tübingen: Max Niemeyer Verlag.

Katz, J., & Selkirk, E. (2011). Contrastive focus vs. discourse-new: Evidence from phonetic prominence in English*. Language, 87 (4)*, 771-816.

Katzir, R. (2013). A note on contrast. *Natural Language Semantics, 21*, 333-343.

Kim, C.S. (2012). *Generating alternatives: Interpreting focus in discourse* (Doctoral dissertation). University of Rochester, New York.

Kim, C. S., Gunlogson, C., Tanenhaus, M. K., & Runner, J. T. (2015). Context-driven expectations about focus alternatives. *Cognition, 139*, 28-49.

König, E. (1991). *The meaning of focus particles: A comparative perspective*. London / New York: Routledge.

Krifka, M. (1991). A compositional semantics for multiple focus constructions. In S.K. Moore, & A.Z. Wyner (Eds.), *Proceedings from Semantics and Linguistic Theory, 1* (pp. 127-158). Cornell University, Ithaca, N.Y.

Krifka, M. (1995). Focus and the interpretation of generic sentences. In G. Carlson, & F. Pelletier (Eds.), *The Generic Book* (pp. 238–264). Chicago: University of Chicago Press.

Krifka, M. (2001). For a structured account of questions and answers. In C. Féry & W. Sternefeld (Eds.), *Audiatur vox sapientiae: A Festschrift for Arnim von Stechow* (pp. 287-319). Berlin: Akademie-Verlag.

Krifka, M. (2007). Basic notions of Information Structure. In C. Féry, F.G. Fanselow & M. Krifka (Eds.), *The notions of information structure. Interdisciplinary studies on information structure, 6* (pp. 13-56). Potsdam: Universitätsverlag Potsdam.

Krifka, M., & Musan, R. (2012). Information structure: Overview and linguistic issues. In M. Krifka & R. Musan (Eds.). *The Expression of Information Structure* (pp. 1-43). Berlin: De Gruyter Mouton.

Kuznetsova, A., Brockhoff, P.B., & Christensen, R.H.B. (2015*). lmerTest: Tests for random and fixed effects for linear mixed effect models*. R package version 2.0-29. https://cran.r-project.org/web/packages/lmerTest/.

LimeSurvey GmbH (2017). *LimeSurvey: An Open Source survey tool.* LimeSurvey GmbH, Hamburg, Germany. URL http://www.limesurvey.org.

Norris, D., Cutler, A., McQueen, J.M., & Butterfield, S. (2006). Phonological and conceptual activation in speech comprehension. *Cognitive Psychology, 53*, 146-193.

Oldfield, R. C., & Wingfield, A. (1965). Response latencies in naming objects. *Quarterly Journal of Experimental Psychology, 4*, 272–281.

Paul, H. (1880). *Principien der Sprachgeschichte*. Halle: Max Niemeyer Verlag.

Pierrehumbert, J. (1980). *The phonology and phonetics of English intonation* (Doctoral dissertation). Massachussets Institute of Technology, Cambridge, Mass.

Pierrehumbert, J., & Hirschberg, J. (1990). The meaning of intonational contours in the interpretation of discourse. In P. Cohen, J. Morgan & M. Pollack (Eds.), *Intentions in Communication* (pp. 271-311). Cambridge, MA: MIT Press.

Pollatsek, A., Juhasz, B.J., Reichle, E.D., Machacek, D., & Rayner, K. (2008). Immediate and Delayed Effects of Word Frequency and Word Length on Eye Movements in Reading: A Reversed Delayed Effect of Word Length. *Journal of Experimental Psychology: Human Perception & Performance, 34 (3)*, 726-750.

Reich, I. (2002). Question/Answer Congruence and the Semantics of wh-phrases. *Theoretical Linguistics*, 28 (1), 73-94.

Repp, S. (2010). Defining contrast as an information-structural notion in grammar. *Lingua, 120*, 1333-1345.

Roberts, C. (1996). Information structure in discourse: Towards an integrated formal theory of pragmatics. In J. H. Yoon & A. Kathol (Eds.), *OSU Working Papers in Linguistics 49: Papers in Semantics* (91-136). The Ohio State University, Columbus.

Rochemont, M.S. (1986). *Focus in Generative Grammar*. Amsterdam/ Philadelphia: John Benjamins Publishing Company.

Rochemont, M. (2013). Discourse New, Focused, and Given. In J. Brandtler, V. Molnár & C. Platzack (Eds), *Approaches to Hungarian: Volume 13: Papers from the 2011 Lund conference* (pp. 199-228). Amsterdam: John Benjamins Publishing Company.

Rooth, M. (1985). *Association with focus* (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge, Mass.

Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics, 1*, 75-116.

Rooth, M. (2016). Alternative Semantics. In C. Féry & S. Ishihara (Eds.), *The Oxford Handbook of Information Structure* (pp. 19-40). Oxford: Oxford University Press.

RStudio Team (2015). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA. Version 1.0.143, retrieved March 2017 from http://www.rstudio.com/.

Schwarzschild, R. (1999). GIVENness, AVOIDF and Other Constraints on the Placement of Accent. *Natural Language Semantics, 7 (2),* 141-177.

Selkirk, E. (2002). Contrastive FOCUS vs. presentational focus: Prosodic Evidence from Right Node Raising in English. In B. Bel & I. Marlin (Eds.), *Proceedings of Speech Prosody 2002. Proceedings of the First International Speech Prosody Conference (pp. 643-646*). Laboratoire Parole et Langage, Université de Provence.

Selkirk, E. (2008). Contrastive focus, givenness and the unmarked status of discourse-new. *Acta Linguistica Hungarica, 55,* 331-346.

Silverman, K.E., Beckman, M.E., Pitrelli, J.F., Ostendorf, M., Wightman, C.W., Price, P., Pierrehumbert, J. & Hirschberg, J. (1992). Tobi: a standard for labeling English prosody. In *Proceedings of the 1992 International Conference on Spoken Language Processing, Vol. 2,* 867-870.

Stalnaker, R.L. (1973). Presuppositions. *Journal of Philosophical Logic, 2*, 447–457.

Stalnaker, R. (1974). Pragmatic presuppositions. In M.K. Munitz & P.K. Unger (Eds.), *Semantics and Philosophy* (pp. 197–214). New York: New York University Press.

Stenneken, P., Conrad, M., & Jacobs, A.M. (2007). Processing of Syllables in Production and Recognitin Tasks. *Journal of Psycholinguistic Research, 36,* 65-78.

Truckenbrodt, H. (2012). On the prosody of German wh-questions. In G. Elordieta & P. Prieto (Eds.), *Prosody and meaning* (pp. 73-118). Berlin: de Gruyter.

Vallduví, E., & Vilkuna, M. (1998). On rheme and kontrast. In P. Culicover & L. McNally (Eds.), *The Limits of Syntax* (pp. 79–106). New York: Academic Press.

van Casteren, M., & Davis, M.H. (2006). Mix, a program for pseudorandomization. *Behavior Research Methods, 38 (4*), 584–589.

von Stechow, A. (1982). *Structured Propositions*. Ms., Universität Konstanz.

von Stechow, A. (1989). *Focusing and Backgrounding Operators*. Technical Report 6, Fachgruppe Sprachwissenschaft, Universitat Konstanz.

von Stechow, A. (1990). Focusing and backgrounding operators. In W. Abraham (Ed.), *Discourse Particles* (pp. 37-84). Amsterdam: John Benjamins.

Wagner, M. (2005). *Prosody and Recursion* (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge, Mass.

Wagner, M. (2006). Givenness and Locality. In M. Gibson & J. Howell (Eds.), *Proceedings of SALT, 16* (pp. 295-312). Ithaca, NY: Cornell University.

Wagner, M. (2012). Focus and givenness: a unified approach. In I. Kuerová & A. Neeleman (Eds.), *Contrasts and Positions in Information Structure* (pp. 102-147). Cambridge: Cambridge University Press.

Ward, G. L., & Hirschberg, J. (1986). *Reconciling Uncertainty with Incredulity A Unified Account of the L*+H L H% Intonational Contour*. [Washington, D.C.]: Distributed by ERIC Clearinghouse, http://www.eric.ed.gov/contentdelivery/servlet/EICServlet?acno=ED285-390 .

Watson, D., Gunlogson, C., & Tanenhaus, M. (2008). Interpreting pitch accents in on-line comprehension: H* vs. L+H*. *Cognitive Science, 32*, 1232-1244.

Zimmermann, M. (2007). Contrastive Focus. In G. Fanselow, C. Féry & M. Krifka (Eds.), *The notions of information structure. Interdisciplinary Studies on Information Structure Vol. 6. Working Papers of the SFB 632* (pp. 147-160). Potsdam: Universitätsverlag Potsdam.

Zimmermann, M., & Onéa, E. (2011). Focus marking and focus interpretation. *Lingua, 121,* 1651-1670.

Appendix A

Table A1

Items used in the study by Braun and Tagliapietra (2010, p. 1041-1043), for which the non-contrastive targets were identified as possible Rooth alternatives.

N°	Sentence including prime word	non-contrastive target
1	Our neighbours assembled an **antenna**	television
2	There was air-conditioning in the **cabin**	plane
3	Anne is dressed up as a **gorilla**	ape
4	Henk ordered a **Jeneva**	drink
5	The kitchen smells like **camomile**	tea
6	Marlies fed the **canary**	bird
7	There were cockles in the **lagoon**	water
8	Marloes attended the **school**	lyceum
9	The vet had to go to the **horse**	stables
10	My neighbour works for the **country**	province
11	The poster hangs from the notice **board**	drawing pin
12	The couple agreed to meet at the **castle**	ruin
13	Christel preferably eats **fish**	sardines
14	Our son loves **vegetables**	spinach
15	Hans bought a piece of **leather**	suede
16	On Saturday I went to the **performance**	theatre
17	The socialist impressed the **rich**	elite
18	The major stopped at the **border**	customs

Table A2

Items used in the study by Husband and Ferreira (2010, p. 18-19), where the non-contrastive target words are of a different semantic type than the prime words.

N°	Sentences including prime word	Non-contrastive target
1	Scientists found the fossils of several **mammoths** during their excavation	extinct

2	The woman wanted to wear her favorite **jeans** to the party	skinny
3	The model adored the new **necklace** during the photo shoot	posh
4	The kennel owner was playing with a **kitten** when the phone rang	furry
5	The manager drove along a **straight** road to reach his appointment	line
6	Her wedding day ended up **rainy** so the reception was moved indoors	tropics
7	The mother was very **gentle** with her children	slope
8	The new purse was **yellow** and had lots of pockets	daisies
9	The suede blazer had gotten **wet** from all the rain	rain
10	The city gets a lot of **snow** during the winter	frozen
11	The host decided to make a drink with **lemons** for the party	sour
12	The guest happened to notice the **eel** in the corner of the tank	slimy
13	Our next-door neighbor was kind of **scary** because of her cat	monster
14	The junior class all had **green** shirts on for the class trip	grass
15	The woman's friend surprised her with **roses** for her birthday	pink
16	The hungry triplets wanted to have **rice** with their dinner	fried
17	The director brought his new **umbrella** with him, just in case	raining
18	The home owners wanted to get the **tiny** dog from the shelter	particle
19	The couple thought the appetizer tasted too **spicy** so they left the restaurant	chili
20	The assistant let her **fear** get in the way of talking to her boss	afraid
21	Although the driveway was a bit too **long**, the couple liked the house	length
22	The group of girls approached the **door** very carefully and quietly	open
23	It was always incredibly **windy** near the top of the mountain	kite
24	They had always been interested in the **wild** aspects of nature	jungle
25	The children could see the **sun** reflected on the surface of the lake	bright
26	The officer's actions were quite **heroic** on that fateful day	ballad
27	The young woman always had **apples** to snack on at work	ripe
28	The archaeologist discovered a **rare** artifact when digging in the desert	chicken
29	The doctor was considered an **honest** man by the people	lawyer

30	The newest room in the house was **square** and painted blue	angles

Table A3

Items used in the study by Husband and Ferreira (2015, p. 18-19), where the non-contrastive targets are not contextually appropriate replacements for the prime word.

N°	Sentence including the prime word	non-contrastive target
1	The museum thrilled the **sculptor** when they called about his work	statue
2	The murderer killed the **nurse** last Tuesday night	clinic
3	The boy liked to feed the **duck** in the park	nest
4	The baker needed to make a **cake** for the big day	birthday
5	The passenger boarded the **airplane** and quickly found his seat	baggage
6	The students heard a **loud** noise behind the building	big
7	The craftsman built the **table** in his work shop	dinner
8	The shopper found the sale prices **inexpensive** when she visited the other store	durable
9	The victim became **hysterical** when she heard the news	mental
10	Every student knew that the homework for **math** was due the next day	numbers
11	The outfit was rather **odd** for such a formal occasion	even
12	They were told to write with a **pencil** instead of typing	eraser
13	The rancher herded his **cows** out of the field	grass
14	All of the new kittens were **grey** and had very small paws	dull
15	Yesterday afternoon, the toddler played with a **turtle** in the back-yard	pond
16	The aunt hired an experienced **attorney** to handle the case	lawsuit
17	The boy wanted to play the **cello** in the youth orchestra	string
18	The boy asked his father to pass the **napkin** to him before he ate	lap
19	The customer thought that the soup was too **cool**, but ate it any-way	humid
20	The artist enjoyed a **cigarette** after the dinner party	lungs
21	They got their dog a **collar** and a new water bowl	leather
22	The renter realized that his apartment had a **termite** infestation	burrow

23	The students wondered why such a **difficult** question had been asked	heavy
24	The manager cleaned his **cup** out before getting a refill	coffee
25	The nanny made sure that the **baby** went to sleep on time	embryo
26	The family owned a small **cabin** that they used during the summer	woods
27	The village was hit by a **hurricane** and was nearly destroyed	clouds
28	The farmer always found a **deer** by the riverbank on his property	antler
29	The meat needed a bit more **salt** to bring out the flavor	ocean
30	The infection was caused by a **bacteria** in the lower intestines	microscope
31	The restaurant featured **salmon** on the menu every weekend	stream

Appendix B

Table B1
List of all critical items used in the cross-modal priming paradigm experiment. Including auditory stimuli, Rooth alternatives (RA), Wagner alternatives (WT) and Unrelated targets (UT)

N°	Auditory stimuli (question and answer), including prime word	RA	WA	UT
1	Was für ein Auto hat Matthias beim Autohändler ausgesucht? Er hat ein **rotes** Auto ausgesucht.	gebraucht	silbern	froh
2	Was für eine Matratze hat Tina im Möbelgeschäft ausprobiert? Sie hat eine **harte** Matratze ausprobiert.	bequem	weich	hilflos
3	Was für eine Lasagne hat Laura im Supermarkt gesucht? Sie hat eine **frische** Lasagne gesucht.	würzig	gefroren	schlau
4	Was für eine Banane hat Nico aus dem Obstkorb genommen? Er hat eine **verfaulte** Banane genommen.	süß	reif	klug
5	Was für eine Aufgabe hat Julius im Matheunterricht gelöst? Er hat eine **einfache** Aufgabe gelöst.	zusätzlich	schwierig	höflich
6	Was für eine Pizza hat Jürgen vom Lieferdienst erhalten? Er hat eine **ekelhafte** Pizza erhalten.	fettig	lecker	geizig
7	Was für ein Kleid hat Romy im Katalog bestellt? Sie hat ein **bedrucktes** Kleid bestellt.	schick	einfarbig	durstig
8	Was für ein Bier hat Johann im Getränkemarkt gesucht? Er hat ein **belgisches** Bier gesucht.	dunkel	englisch	friedlich
9	Was für ein Gericht hat Ben im Restaurant gegessen? Er hat ein **scharfes** Gericht gegessen.	vegan	mild	grell

10	Was für einen Buntstift hat Paul in der Federtasche gefunden? Er hat einen **stumpfen** Buntstift gefunden	gelb	spitz	ernst
11	Was für einen Lippenstift hat Bettina im Kaufhaus geklaut? Sie hat einen **billigen** Lippenstift geklaut.	matt	teuer	eilig
12	Was für ein Geschäft hat Maren in der Fußgängerzone bemerkt? Sie hat ein **offenes** Geschäft bemerkt.	günstig	geschlossen	geduldig
13	Was für ein Badesalz hat Jakob in der Drogerie gekauft? Er hat ein **stinkendes** Badesalz gekauft.	sprudelnd	duftend	lachend
14	Was für eine Katze hat Marie auf der Wiese eingefangen? Sie hat eine **wilde** Katze eingefangen	putzig	zahm	oval
15	Was für eine Jacke hat Martin im Schrank aufgehängt? Er hat eine **nasse** Jacke aufgehängt.	schmutzig	trocken	schädlich
16	Was für eine Straße hat Arne in der Altstadt überquert? Er hat eine **enge** Straße überquert.	belebt	breit	blass
17	Was für eine Bluse hat Mia auf dem Flohmarkt erworben? Sie hat eine **hässliche** Bluse erworben.	elegant	hübsch	wütend
18	Was für eine Suppe hat Patrick in der Mensa gekriegt? Er hat eine **kalte** Suppe gekriegt.	salzig	heiß	still
19	Was für ein Baby hat Katharina auf dem Schoß gewiegt? Sie hat ein **hungriges** Baby gewiegt.	ruhig	satt	giftig
20	Was für ein Geräusch hat Florian im Keller gehört? Er hat ein **lautes** Geräusch gehört.	seltsam	leise	nackt
21	Was für ein Buch hat Georg in der Schule gelesen? Er hat ein **spannendes** Buch gelesen.	historisch	langweilig	zufrieden
22	Was für eine Liege hat Anna am Strand entdeckt?			

	Sie hat eine **freie** Liege entdeckt.	kaputt	belegt	müde
23	Was für einen Gesichtsausdruck hat Lars nach der Firmenfeier gehabt? Er hat einen **traurigen** Gesichtsausdruck gehabt.	komisch	fröhlich	einstimmig
24	Was für einen Wein hat Thomas zum Abendessen gereicht? Er hat einen **herben** Wein gereicht.	fruchtig	lieblich	sportlich
25	Was für einen Teich hat Sophia im Garten geplant? Sie hat einen **riesigen** Teich geplant.	flach	winzig	heiter
26	Was für einen Tag hat Peter in der Stadt verbracht?? Er hat einen **entspannten** Tag verbracht.	toll	hektisch	schief
27	Was für ein Sofa hat Erik vom Möbelgeschäft bekommen? Er hat ein **dreckiges** Sofa bekommen.	löchrig	sauber	ehrlich
28	Was für einen Kaffee hat Miriam zum Frühstück getrunken? Sie hat einen **starken** Kaffee getrunken.	schwarz	schwach	negativ
29	Was für einen Apfel hat Anja für den Obstsalat geschnitten? Sie hat einen **mehligen** Apfel geschnitten.	sauer	knackig	positiv
30	Was für einen Müllsack hat Sebastian in den Container geworfen? Er hat einen **überfüllten** Müllsack geworfen.	eklig	leer	lahm
31	Was für ein Mädchen hat Robert nach Hause gebracht? Er hat ein **betrunkenes** Mädchen gebracht.	freundlich	nüchtern	stechend
32	Was für eine Perücke hat Susann zu Silvester getragen? Sie hat eine **blonde** Perücke getragen.	verrückt	braun	neugierig
33	Was für einen Jungen hat Inis in der Praxis untersucht? Sie hat einen **gesunden** Jungen untersucht.	nervös	krank	knusprig
34	Was für einen Schüler hat Saskia im Unterricht gelobt? Sie hat einen **faulen** Schüler gelobt.	lebhaft	fleißig	köstlich

35	Was für ein Fenster hat Simon in den Hausflur eingebaut? Er hat ein **rundes** Fenster eingebaut.	schmal	eckig	streng
36	Was für eine Läuferin hat Tim beim Training beobachtet? Er hat eine **langsame** Läuferin beobachtet.	schlecht	schnell	knapp
37	Was für einen Pullover hat Vera im Skiurlaub angehabt? Sie hat einen **dünnen** Pullover angehabt.	kratzig	dick	stolz
38	Was für einem Mann ist Sarah im Theater begegnet? Sie ist einem **berühmten** Mann begegnet.	nett	unbekannt	erhöht
39	Was für einen Drachen hat Nils für den Comic gezeichnet? Er hat einen **lieben** Drachen gezeichnet.	bunt	böse	saftig
40	Was für ein Kind hat Maria im Kindergarten angeschrien? Sie hat ein **braves** Kind angeschrien.	nervig	frech	schimmelig
41	Was für einen Ton hat Melanie auf der Geige erzeugt? Sie hat einen **hohen** Ton erzeugt.	klar	tief	sozial
42	Was für ein Rinderfilet hat Beate im Delikatessenladen getestet? Sie hat ein **mageres** Rinderfilet getestet.	zart	fett	einsam
43	Was für ein Bein hat Karl bei der Party berührt? Er hat ein **haariges** Bein berührt.	schlank	glatt	dumm
44	Was für ein Mehl hat Neele zum Backen verwendet? Sie hat ein f**eines** Mehl verwendet.	hell	grob	steil
45	Was für einen Piraten hat Malte im Schultheater gespielt? Er hat einen **ängstlichen** Piraten gespielt.	lustig	mutig	deutlich

Table B2
List of all filler items used in the cross-modal priming paradigm experiment. Including auditory stimuli and target word

N°	Auditory stimuli (question and answer)	Target word
46	Was für eine Bohrmaschine hat Johannes für das Regal gebraucht? Er hat eine **leistungsstarke** Bohrmaschine gebraucht.	hochfretig
47	Für was für einen Eintopf hat Emma sich entschieden? Sie hat sich für einen **deftigen** Eintopf entschieden.	herzhakt
48	Was für einen Mann hat Hanna in der Disko angestarrt? Sie hat einen **gutaussehenden** Mann angestarrt.	appraktriv
49	Von was für einer Leiter ist Lea im Garten gestürzt? Sie ist von einer **wackligen** Leiter gestürzt.	glüchik
50	Was für einer Mitstreiterin hat Klara zum Sieg gratuliert? Sie hat einer **ehrgeizigen** Mitstreiterin gratuliert.	negabt
51	Was für eine Rede hat Lara bei der Abschiedsfeier gehalten? Sie hat eine **emotionale** Rede gehalten.	odü
52	Was für einen Tunnel hat Pia in der Burg betreten? Sie hat einen **geheimen** Tunnel betreten.	schmunkel
53	Was für eine Tante hat Mira in den USA besucht? Sie hat eine **reiche** Tante besucht.	zicklif
54	Was für eine Eiscreme hat Merle im Kühlfach verstaut? Sie hat eine **selbstgemachte** Eiscreme verstaut.	solkig
55	Was für einen Flug hat Oliver nach Paris gebucht? Er hat einen **späten** Flug gebucht.	frichick
56	Was für einen Vortrag hat Vanessa bei der Konferenz gehört?	

	Sie hat einen **interessanten** Vortrag gehört.	launüch
57	Was für ein Fahrrad hat Richard im Hotel ausgeliehen? Er hat ein **klappriges** Fahrrad ausgeliehen.	göltig
58	Was für eine Bemerkung hat Birgit in der Küche gemacht? Sie hat eine **vulgäre** Bemerkung gemacht.	fräurig
59	Was für ein Lied hat Kristoffer beim Karaoke gesungen? Er hat ein **peinliches** Lied gesungen.	kraftsos
60	Was für ein Reinigungsmittel hat Henriette im Bad verwendet? Sie hat ein **chemisches** Reinigungsmittel verwendet.	fleiker
61	Wer ist von einem dröhnenden Hämmern auf der Straße aufgewacht? **Lilli** ist von einem dröhnenden Hämmern aufgewacht.	Jasmin
62	Wer hat einen angemessenen Preis für die Kette bezahlt? **Marlene** hat einen angemessenen Preis bezahlt.	Feel
63	Wer hat einen besonderen Likör nach dem Essen empfohlen? **Emilia** hat einen besonderen Likör empfohlen.	Heibe
64	Wer hat eine furchtbare Situation in den Ferien erlebt? **Lina** hat eine furchtbare Situation erlebt.	Pflura
65	Wer hat einen vernarbten Rücken auf der Messe tätowiert? **Noah** hat einen vernarbten Rücken tätowiert.	Dietrich
66	Wer hat mit einer langjährigen Freundin in der Disko gefeiert? **Leonie** hat mit einer langjährigen Freundin gefeiert.	Iris
67	Wer ist mit einer unseriösen Fluggesellschaft in den Urlaub geflogen? **Henri** ist mit einer unseriösen Fluggesellschaft geflogen.	Erpika
68	Wer ist zu einem beliebten Wochenmarkt im Stadtzentrum gegangen? **Niklas** ist zu einem beliebten Wochenmarkt gegangen.	Pulie

69	Wer hat eine einwöchige Kreuzfahrt im Mittelmeer gewonnen? **Moritz** hat eine einwöchige Kreuzfahrt gewonnen.	Rosa
70	Wer hat auf einen eindeutigen Sieg beim Wettlauf gehofft? **Oskar** hat auf einen eindeutigen Sieg gehofft.	Agfes
71	Wer ist mit einer rutschenden Hose durch den Wald gejoggt? **Charlotte** ist mit einer rutschenden Hose gejoggt.	Christin
72	Wer ist auf einen morschen Baum im Hinterhof geklettert? **Maja** ist auf einen morschen Baum geklettert.	Theekler
73	Wer hat einen großen Truthahn fürs Weihnachtsessen zubereitet? **Alex** hat einen großen Truthahn zubereitet.	Otfo
74	Wer hat ein altes Fitnessgerät aus dem Keller entstaubt? **Matilda** hat ein altes Fitnessgerät entstaubt.	Trompete
75	Wer hat ein kurzes T-Shirt beim Sport angehabt? **Eileen** hat ein kurzes T-Shirt angehabt.	Teppich
76	Wer hat einen sympathischen Herrn beim Konzert angelächelt? **Paula** hat einen sympathischen Herrn angelächelt.	Sonne
77	Wer hat eine arme Familie in der Nachbarschaft unterstützt? **Isabella** hat eine arme Familie unterstützt.	Plaus
78	Wer hat sich an ein freudiges Fest im Park erinnert? **Joachim** hat sich an ein freudiges Fest erinnert.	Becher
79	Wer hat einen aktiven Handballer für den Artikel interviewt? **Robin** hat einen aktiven Handballer interviewt.	Heiklel
80	Wer hat eine afrikanische Sprache im Spracheninstitut gelernt? **Kim** hat eine afrikanische Sprache gelernt.	Besen
81	Wer hat einen gewaltigen Koffer für die Reise gepackt?	

	Elisa hat einen gewaltigen Koffer gepackt.	Plaupe
82	Wer hat einen anspruchsvollen Job im Bundestag begonnen? **Tabea** hat einen anspruchsvollen Job begonnen.	Lommel
83	Wer hat mit einem kriminellen Teenager im Büro geredet? **Nina** hat mit einem kriminellen Teenager geredet.	Tülcher
84	Wer ist ein ungestümes Pony in den Bergen geritten? **Dörte** ist ein ungestümes Pony geritten.	Frutta
85	Wer hat einen merkwürdigen DJ fürs Fest engagiert? **Damaris** hat einen merkwürdigen DJ engagiert.	Perz
86	Wer hat ein nützliches Schulfach in der Oberstufe gewählt? **Karin** hat ein nützliches Schulfach gewählt.	Dosep
87	Wer hat eine enorme Summe beim Hausbau gespart? **Michael** hat eine enorme Summe gespart.	Frild
88	Wer hat eine radikale Meinung zum Thema geäußert? **Philipp** hat eine radikale Meinung geäußert.	Schmugel
89	Wer hat einen tapferen Soldaten in der Kaserne getroffen? **Bente** hat einen tapferen Soldaten getroffen.	Fratue
90	Wer hat einen raffinierten Plan für den Polizeieinsatz erläutert? **Jörg** hat einen raffinierten Plan für den Polizeieinsatz erläutert.	Mifter
91	Wer hat sich einen wachsamen Hund fürs Haus gewünscht? **Bernd** hat sich einen wachsamen Hund gewünscht.	Schrucker
92	Wer hat ein unglaubliches Tor beim Freundschaftsspiel geschossen? **Hugo** hat ein unglaubliches Tor geschossen.	Sahm
93	Wer hat eine anständige Antwort auf die Frage verdient? **Norbert** hat eine anständige Antwort verdient.	Papiem

94	Wer hat eine gefährliche Terroristin im Einsatz getötet? **Nora** hat eine gefährliche Terroristin getötet.	Faar
95	Wer hat eine persönliche Bestzeit beim Wettbewerb erreicht? **Viktoria** hat eine persönliche Bestzeit erreicht.	Kliep
96	Was hat Brigitte gemacht? Sie hat mit einem neuen Training im Fitnessstudio angefangen.	Sportfrelein
97	Was hat Felix gemacht? Er hat mit einem erfahrenen Vorgesetzten in der Firma gesprochen.	Betrieb
98	Was hat Lena gemacht? Sie hat ein hölzernes Vogelhaus für den Garten gebaut.	Hog
99	Was hat Georg gemacht? Er hat einen guten Bekannten in Frankreich besucht.	Klanien
100	Was hat Kathrin gemacht? Sie hat einen kindergerechten Stuhl zum Tisch gebracht.	Parsti
101	Was hat Klaus gemacht? Er hat sich einen gemeinen Streich für Halloween ausgedacht.	Fasching
102	Was hat Frauke gemacht? Sie hat mit einem hartnäckigen Studenten im Vorlesungssaal diskutiert.	Brüro
103	Was hat Jonas gemacht? Er hat sich über eine zornige Kontrolleurin in der Bahn aufgeregt.	Bus
104	Was hat Elias gemacht? Er hat ein heruntergekommenes Zimmer in der Wohnung gestrichen.	Schuppen
105	Was hat Leon gemacht? Er hat eine umstrittene Theorie im Seminar erklärt.	Maum
106	Was hat Finn gemacht?	

	Er hat von einem abgelegenen Strand in Thailand erzählt.	Australien
107	Was hat Max gemacht? Er hat ein kompliziertes Experiment für das Projekt vorbereitet.	Stein
108	Was hat Emil gemacht? Er hat einen schlafenden Löwen im Zoo fotografiert.	gähment
109	Was hat Luisa gemacht? Sie hat sich auf ein erholsames Wochenende in der Heimat gefreut.	Fland
110	Was hat David gemacht? Er hat einer gutmütigen Nachbarin mit dem Einkauf geholfen.	Rüll
111	Was hat Anton gemacht? Er hat eine gruselige Maske für den Karnevalsumzug gebastelt.	Mafrini
112	Was hat Tom gemacht? Er hat ein kleines Geschenk unter dem Tannenbaum platziert.	Combufter
113	Was hat Johanna gemacht? Sie hat nach einem festen Garn im Nähkästchen geschaut.	Volllaten
114	Was hat Jan gemacht? Er hat einen langen Text für den Deutschunterricht geschrieben.	Kanifchen
115	Was hat Lisa gemacht? Sie hat einen frankierten Umschlag auf den Tisch gelegt.	Lehrpler
116	Was hat Leo gemacht? Er hat eine antike Vase im Museum fallenlassen.	Schegeft
117	Was hat Jannik gemacht? Er hat einer jungen Reporterin bei der Recherche zugeschaut.	Krünterview
118	Was hat Till gemacht? Er hat eine seltene Frucht am Obststand probiert.	Feune

119	Was hat Linda gemacht? Sie hat ein leichtes Paket ins Ausland verschickt.	Körsche
120	Was hat Mona gemacht? Sie hat ein feuchtes Handtuch auf die Wäscheleine gehängt	Zeizung
121	Was hat Samuel gemacht? Er hat einen unerfahrenen Auszubildenden in der Werkstatt herumgeführt.	Karpel
122	Was hat Cornelius gemacht? Er ist mit einer populären Band durchs Land gereist.	Welm
123	Was hat Mats gemacht? Er hat einen ermüdeten Schwimmer aus den Fluten gerettet.	Schasse
124	Was hat Susanne gemacht? Sie hat eine talentierte Tänzerin vor dem Auftritt geschminkt.	Schauwe
125	Was hat Ingrid gemacht? Sie hat einen mittelalterlichen Volkstanz auf der Bühne präsentiert.	Ameise
126	Was hat Hermann gemacht? Er hat einen kontroversen Kommentar auf der Internetseite veröffentlicht.	Dübel
127	Was hat Barbara gemacht? Sie hat eine mündliche Prüfung im Sprachkurs vermasselt.	Teller
128	Was hat Dirk gemacht? Er hat bei einem packenden Theaterstück in Berlin geweint.	Kamm
129	Was hat Ralf gemacht? Er hat eine plagiierte Textstelle in der Hausarbeit markiert.	Ziger
130	Was hat Ute gemacht? Sie hat eine moderne Skulptur an der Wand montiert.	Töl

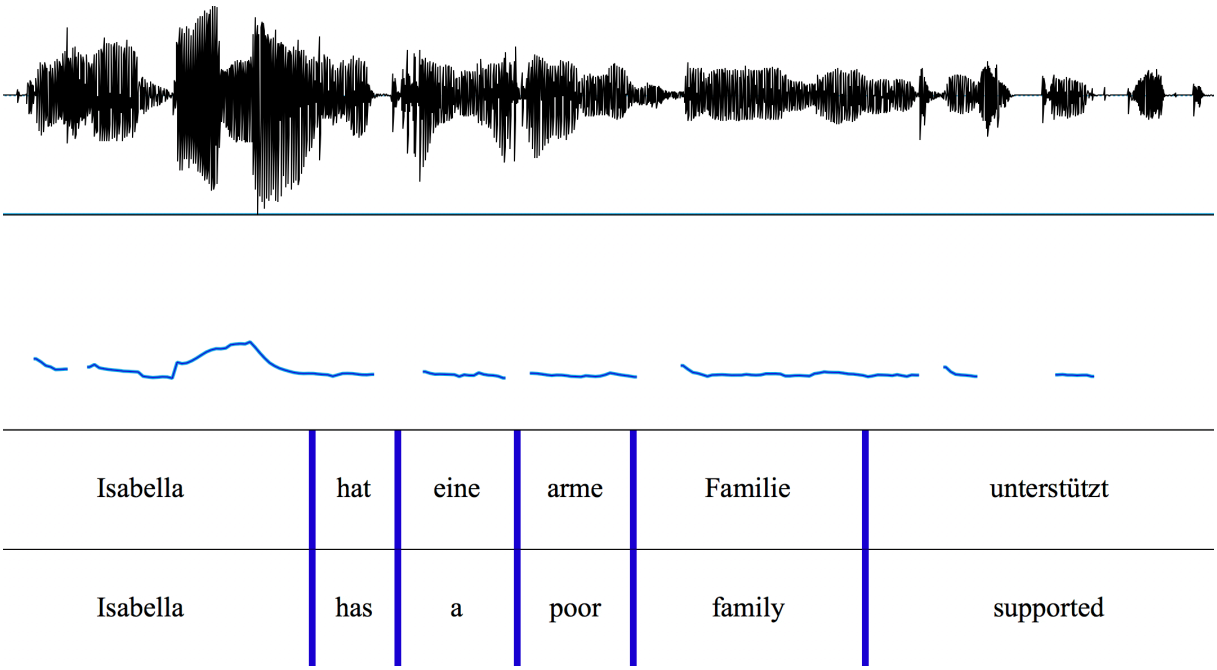

Figure B3
Exemplary illustration of the pitch contour in answers with a narrow focus on the subject.

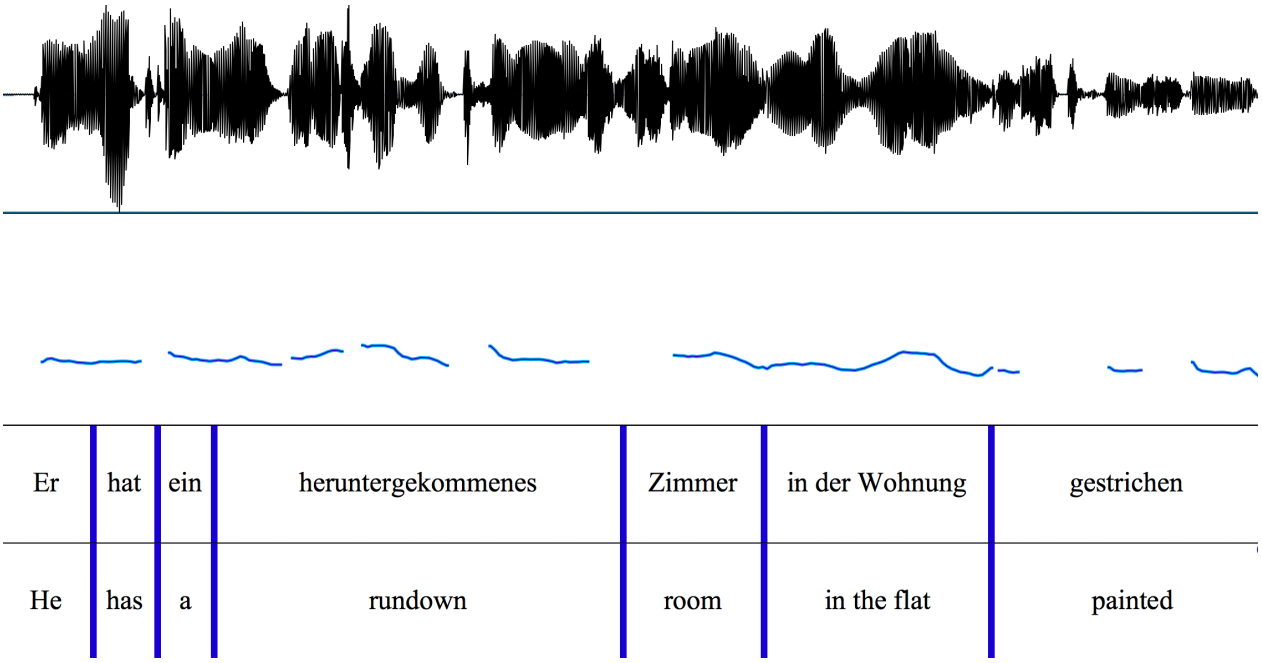

Figure B4
Exemplary illustration of the pitch contour in answers with a wide focus (focused verb phrase)